REPORT RESUMES

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PROGRAM OF EDUCATIONAL REQUIREMENTS FOR EXPERIMENTAL LEARNING CENTERS IN STATE COLLEGES IN PENNSYLVANIA.

EDUCATIONAL RESEARCH SERVICES INC.

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THE REPORT COMMUNICATES TO ARCHITECTS THE DIFFERENCES BETWEEN THE FUNCTIONS CONTEMPLATED IN EXPERIMENTAL LEARNING CENTERS AND THE ACTIVITIES CONVENTIONALLY ASSUMED TO TAKE PLACE IN TYPICAL SCHOOLS AND PARTICULARLY CAMPUS LABORATORY SCHOOLS. THE NEW CONCEPT OF EXPERIMENTAL LEARNING CENTERS REQUIRES ORIGINAL AND CREATIVE ARCHITECTURAL PLANNING. THE FUNCTIONS OF THE CENTERS ARE FOR--(1) RESEARCH AND EXPERIMENTATION, (2) DEVELOPMENT AND DEMONSTRATION, (3) PROVIDING SERVICES TO SCHOOL SYSTEMS AND (4) TRAINING TEACHERS. THOUGH THE PRIMARY FUNCTION IS RESEARCH AND EXPERIMENTATION, THE SUBSTANCE OF THE ACTIVITY IN THESE CENTERS WILL BE THE DEVELOPMENT OF GOOD EDUCATION. GOOD EDUCATION REQUIRES ATTENTION TO SOME OF THE SPECIAL ENVIRONMENTAL CONDITIONS ESSENTIAL TO EFFECTIVE LEARNING. THE REPORT GOES ON TO DESCRIBE THE EXPERIMENTAL LEARNING CENTERS IN TERMS OF--(1) THE CONCEPT OF SPACE ORGANIZATION, (2) THE SCHOOL CHILDREN'S COMPONENT, (3) THE COLLEGE COMPONENT, (4) EDUCATIONAL TELEVISION FACILITIES, (5) THE STATISTICAL LABORATORY, (6) SPACE REQUIREMENTS AND (7) A CHECKLIST OF SPECIAL FEATURES. THE APPENDIX INCLUDES THE FOLLOWING SECTIONS--(1) BASIC QUESTIONS TO BE ANSWERED IN DETERMINING FACILITIES FOR STATE COLLEGE EXPERIMENTAL CENTERS IN PENNSYLVANIA, (2) SOME EDUCATIONAL IMPERATIVES AND THEIR IMPLICATIONS FOR ELEMENTARY SCHOOL FACILITIES, (3) LABORATORY SCHOOLS IN PERSPECTIVE, (4) TRENDS IN FACILITIES FOR ELEMENTARY EDUCATION AND (5) LARGE-GROUP INSTRUCTION SPACES. (RK)

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Program of Educational Requirements for EXPERIMENTAL LEARNING CENTERS

State Colleges in Pennsylvania

ERS Educational Research Services inc. SCHOOL AND COLLEGE CONSULTANTS

PROGRAM OF EDUCATIONAL REQUIREMENTS
FOR
EXPERIMENTAL LEARNING CENTERS
IN
STATE COLLEGES IN PENNSYLVANIA

December, 1962

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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ERS
Educational
Research
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SCHOOL AND COLLEGE CONSULTANTS 7 HOLLAND AVENUE / WHITE PLAINS, NEW YORK

December 27, 1962

Dr. Richard A. Dershimer, Coordinator
Curriculum Research and Development
State Department of Public Instruction
Harrisburg, Pennsylvania

Dear Dr. Dershimer:

We respectfully submit herewith our Program of Educational Requirements for Experimental Learning Centers in State Colleges in Pennsylvania. It is our belief that the educational purposes embodied in this report should go far in the advancement of education in Pennsylvania through the State Colleges.

While we assume full responsibility for the contents of this report, we must fully acknowledge the leadership of Dr. Charles H. Boehm, State Superintendent of Public Instruction, and the constructive and collaborative contributions of various specialists in the Department of Public Instruction and representatives of the Pennsylvania State Colleges involved.

It is our hope that this will serve as a useful point of departure for the additional planning of this distinctive function for the State Colleges and the facilities which will serve it.

Respectfully yours,

F. G. Cornell
Francis G. Cornell

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I

INTRODUCTION

As a program of educational requirements, this document is intended to serve as the guide line for the work of the architect. As the following pages will show, the idea which has been developed for the experimental learning Centers is new and as such requires original and creative architectural planning.

The results of deliberations and thinking on the part of the Consultants and many other participants are included in this report as a means of communicating to the architect the differences between the functions contemplated in these Centers and activities conventionally assumed to take place in typical schools and particularly campus "laboratory schools".

Background of the Proposal

The Superintendent of Public Instruction for the Commonwealth of Pennsylvania, Charles H. Boehm, in including funds in the 1963-65 biennial capital budget program for educational research centers in six state colleges, had in mind bringing about a closer working relationship between research personnel and teachers and administrators in local school districts. It was his feeling that the traditional campus laboratory school, as generally operated, was not the type of facility which would serve this type of function. For this reason, a grant from the Educational Facilities Laboratories, Inc. was obtained for purposes of employing consultants and of developing the program of requirements for this new type of facility.

The intent is to construct such facilities in the next biennium in Millersville State College, West Chester State College, Kutztown State College and California State College and to begin architectural planning for these Centers in Edinboro State College and Indiana State College.

Participants

The development of this program of requirements has been under the direction of Educational Research Services, Inc., and under the immediate supervision of Dr. Richard A. Dershimer, Coordinator, Curriculum Research and Development Projects, Pennsylvania State Department of Public Instruction. Special consultants engaged by Educational Research Services, Inc. were brought in to an early initial conference and representatives from the State Colleges and the State Department of Public Instruction worked over a period of several months on various aspects of preparing this document.

In addition, a large number of heads of laboratory schools and directors of research in colleges and universities participated through correspondence conducted by Educational Research Services, Inc. on the subject of functions of research and functions of so-called "laboratory" facilities in teacher training institutions. Among those who directly participated in deliberations leading to this report are the following:

From State Colleges

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George Bond, Edinboro
Arnold Fletcher, West Chester
Charles D. Leach, Indiana
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Chalmers Means, Administrative Assistant to the Coordinator of Curriculum Research and Development Projects
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II

FUNCTIONS OF THE CENTERS

During the initial work on this project there was considerable analysis and discussion of the purposes or functions and activities which the facilities were to serve. In the Appendix is a document entitled, "Basic Questions to be Answered in Determining Facilities for State College Experimental Centers in Pennsylvania", which served as an agenda for a conference in Harrisburg on October 23 and 24, 1962. The first part of this document lists several questions which were considered.

In short, the major functions of the Centers, in order of priority, are as follows:

1. Research and experimentation with emphasis upon tryout and initial revision of new curriculum materials and instructional methods and field testing of educational practices developed through experimentation either within the Center or elsewhere, rather than upon what is commonly called pure or basic research, whether or not it is related to education.

2. Demonstration and development of improved educational practices in the geographic area served by the respective institutions -- or the promotion of new and improved educational methods.

3. Providing services to school systems in the respective college service areas. This may be expected to take on the form of technical assistance to school systems and data processing services, testing and special consulting, very much related to function number 2 above.

4. Training of teachers. This objective is listed last because it is assumed that if the three previous functions are emphasized, the teacher training function will best be served. It is not to be considered important to have a facility for practice teaching or a facility for observation exclusively. Yet through means which are to be discussed it is expected that the experimental activities undertaken in the facility will very frequently be sources of information to be consumed both by college students in training for teaching and teachers working in school systems who will be brought into the Center to observe and otherwise gain new knowledge and new experience which is generated there.

Included in the Appendix is one of the working papers used in the October Conference in Harrisburg entitled, "Laboratory Schools in Perspective". Discussed there is the laboratory school as it has evolved in the United States. The experimental learning Centers will differ from laboratory schools, as they are commonly known, in that it is not expected that a regular typical school organization of grades kindergarten through six will necessarily exist.

Initially these schools may be in effect small elementary schools, as in the past, with grades kindergarten through six. As they become more and more "project oriented" with operations in them existing only as an aspect of an experimental activity, the kinds of pupils may be expected to vary depending upon the experimental work which requires them as subjects.

Not to be overlooked is that fact that much research and experimentation in education requires data from several different schools. Not all experimental objectives of these Centers can be fulfilled within the confines of the Centers themselves. In other words, there will be a research staff working in these Centers whose subjects may be pupils, classes or schools in the area being served by the college.

In the Appendix is another document entitled "Some Educational Imperatives and Their Implications for Elementary School Facilities", which was used as a working paper in the October Harrisburg Conference. The paper notes some improved understandings about teaching and learning and points out some implications for the kinds of spaces, the kinds of learning environment, which are required for good education. It is assumed that the individual pupils and groups of pupils which will be subjects for the demonstrations and development of improved methods will be primarily on the elementary level and that the activities in all cases will be steps in the direction of the search for improved practices in education. The document on elementary school facilities should be considered as part of the orientation of the architect in thinking about the function of the Centers.

To be sure, though the primary function is research and experimentation, the substance of the activity in these Centers will be the development of good education. Good education requires attention to some of the special environmental conditions essential to effective learning.

III

A CONCEPT OF SPACE ORGANIZATION

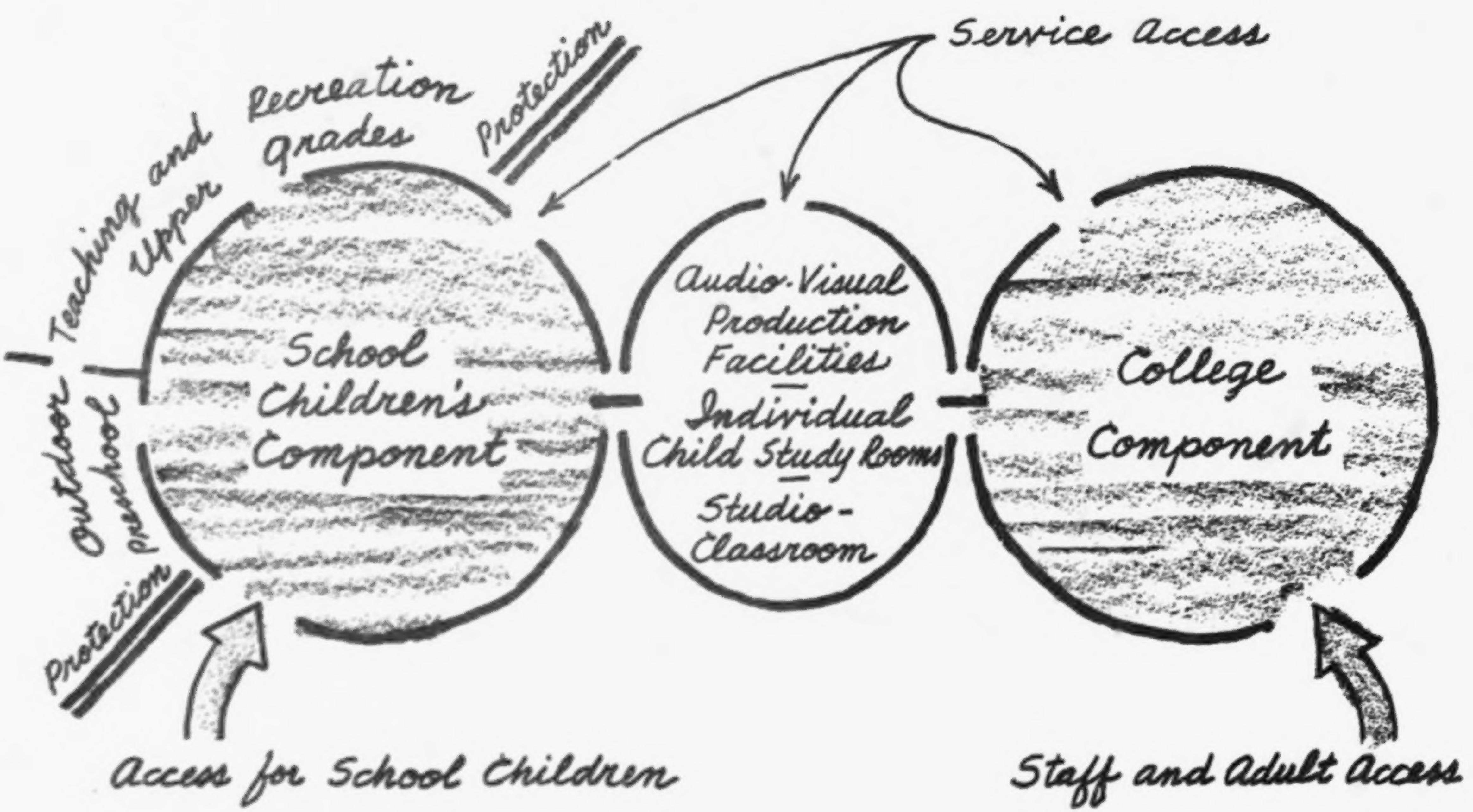
The principal elements of the Center are shown in the accompanying diagram. It is expected that there will be children of school age in classes of various sizes or in various types of organizations varying from individual study to large-group instruction.

Since these are to be young children, primarily of elementary school age, learning environment should be designed suitable to the scale of children of this age. One component is thus the School Children's Component. It will include spaces for various types of learning.

Closely associated with the learning activities of pupils will be the activities of college faculty and staff that are preparing materials for new curricula, developing new types of communication and teaching media, and conducting various activities associated with research such as scoring, tabulating, processing data, etc.

In addition, it is assumed that some instruction of college students would be intimately related to the experimental activities of the Centers so that there would be some formal classes for college students conducted in the Centers.

Since the Centers are to serve teachers in-service, it is expected that there will be evening classes and workshops in the Centers themselves where the emphasis is disseminating information and explaining new developments which are generated within the Centers. For these reasons there is the College Component.


Service Access
Teaching and Recreation
Upper grades
Protection
Outdoor
preschool
Protection
School Children's Component
Audio-Visual Production Facilities
Individual Child Study Rooms
Studio-Classroom
College Component
Access for School Children
Staff and Adult Access

PRINCIPAL ELEMENTS OF THE CENTER

A link between the School Children's Component and the College Component is the audio-visual complex of spaces which, as explained below, will serve to communicate information to college classrooms and others, both on the campus and elsewhere, utilizing closed-circuit television and open-circuit television. Other spaces to be occupied, both by researchers and pupils, are expected to form a link between the two components.

A Checklist of Special Features of some spaces appears in Chapter IX of this report and in separate chapters.

IV

THE SCHOOL CHILDREN'S COMPONENT

The School Children's Component consists of two basic elements. These are large learning and teaching spaces, each capable of handling 100 or more pupils, or the equivalent of four ordinary classrooms. They are not to contain classrooms in the conventional sense. On the assumption that instruction will take place in these spaces with a great variety of types of grouping of pupils, these spaces will be subdivided by means of movable walls, storage walls, or temporary partitions, either to form conventional classrooms or other spaces to accommodate educational practices requiring various combinations of groups of school children. Also in these two learning and teaching spaces is to be the feeding of such pupils as will be housed in them for their basic instruction.

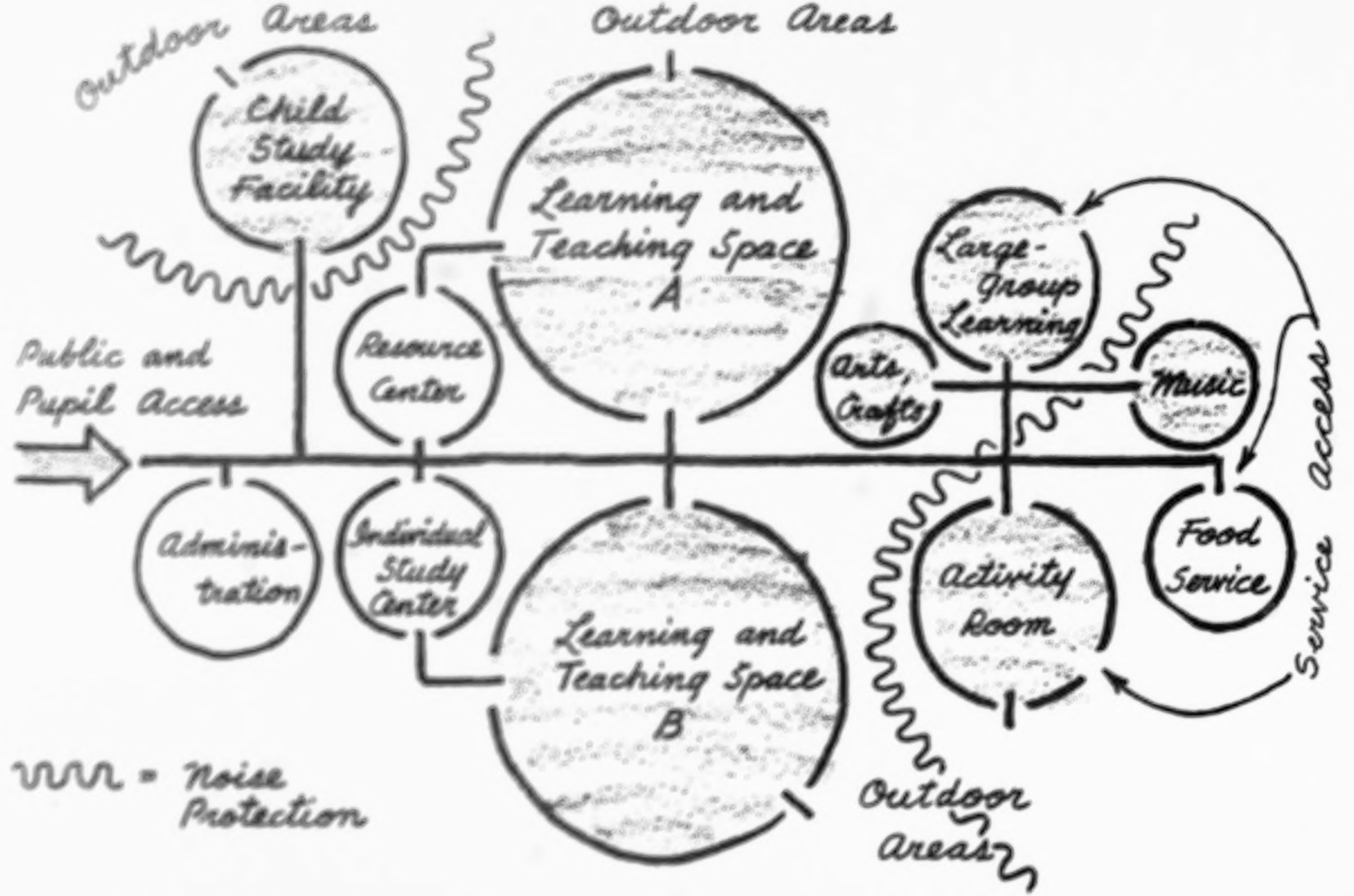
A possible additional component is a Child Study Facility to be used as a kindergarten or nursery school, and thus to house small pre-school or kindergarten children. For the usual reasons, it is desirable to separate the very small children from the older ones.

In addition to these learning spaces are facilities for administrative offices, an activity room or multi-purpose room for assembling as many as 200 pupils and for physical education and recreation, an arts and crafts room and a music room. To the degree that the learning and teaching spaces described above cannot be arranged to handle large groups of children, as many as 100 or 150 should this be necessary, a special large-group learning space might be included.

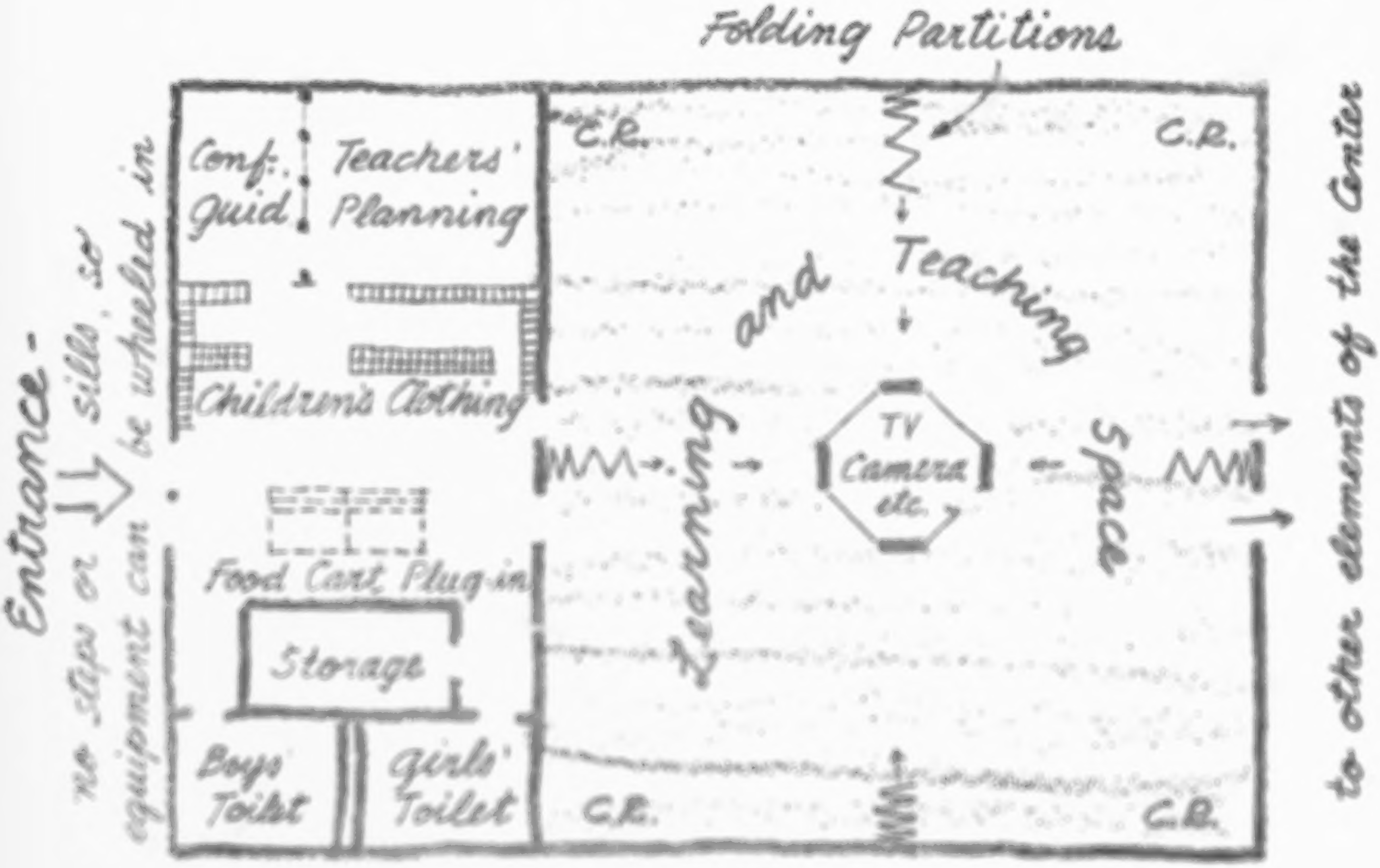
There are also food service or kitchens and a Resource Center which will be the place for the storage of educational media -- books, tapes and recordings -- and associated with it an Individual Study Center which will be the place where individual students may go for learning. This will probably entail carrels or booths in which, from time to time, there will be installed various types of electronic equipment for individual instruction, teaching machines with both audio and visual presentations, programmed instruction materials and various other media for individual instruction. The Individual Study Center may be a separate room or it may be incorporated into the Resource Center itself.

The Resource Center would be primarily a storage space and space for specialized individual study and research. It is assumed that the learning and teaching activities in Centers will require large amounts of resource materials for learning in the learning areas where pupils will spend most of their time, not just in a library in the conventional sense.

The organization of spaces in the School Children's Component is shown schematically in the accompanying diagram. Following it are two schemes for planning the learning and teaching spaces which have been described. These are not presented as drawings. They are intended to be schematic. Scheme A provides for teacher planning spaces, conference rooms, children's clothing, a place for food carts and storage and toilets to one side of a large learning area arranged flexibly with folding partitions in the center of which is located a space for TV cameras and other electronic equipment. It is expected that

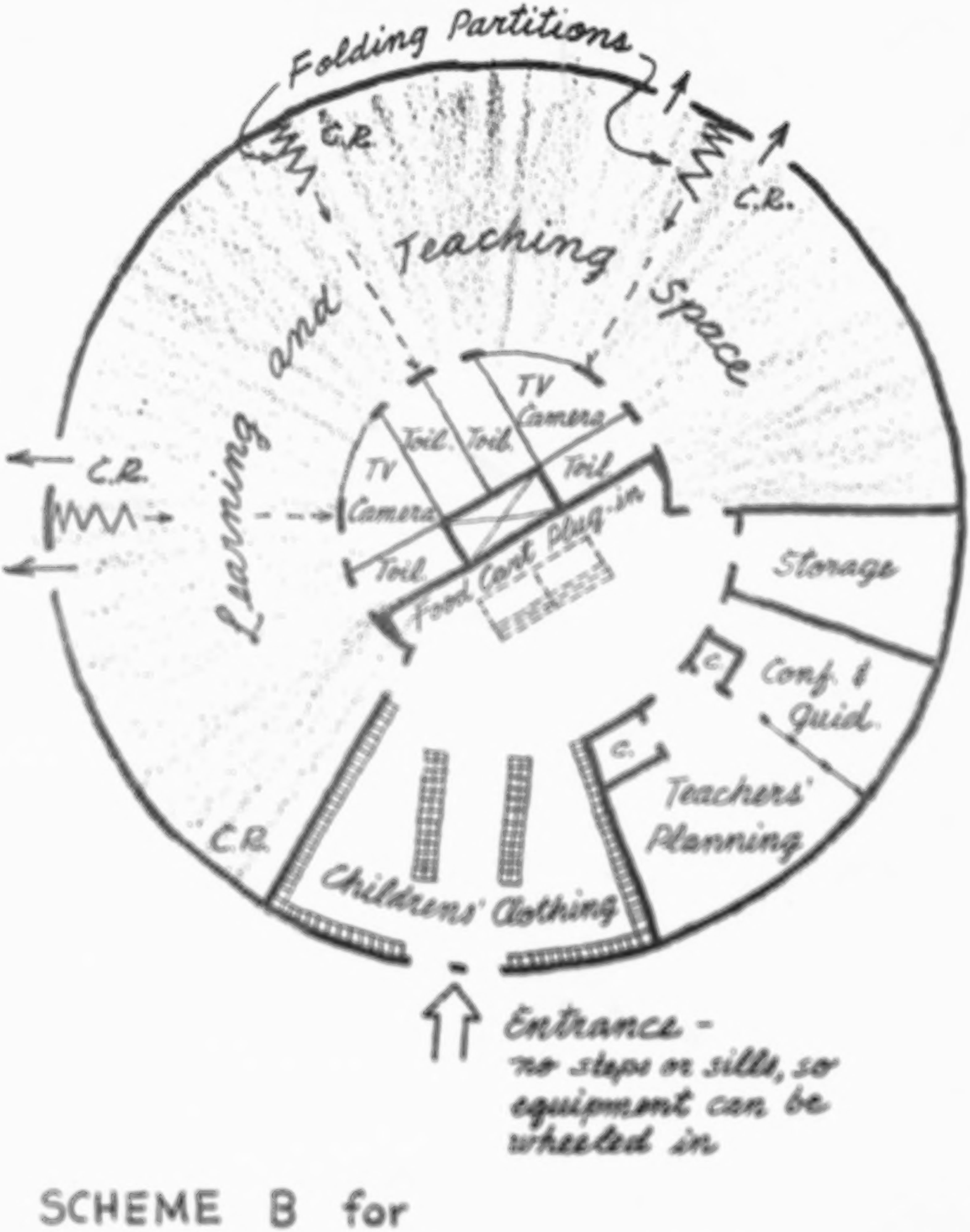

Outdoor Areas
Outdoor Areas
Child Study Facility
Learning and Teaching Space A
Public and Pupil Access
Resource Center
Large-Group Learning
Arts, Crafts
Music
Administration
Individual Study Center
Learning and Teaching Space B
Activity Room
Food Service
Service Access
Outdoor Areas
= Noise Protection

SPACE ORGANIZATION - SCHOOL CHILDREN'S COMPONENT


Folding Partitions
Entrance -
no steps or sills, so equipment can be wheeled in
Conf. Guid.
Teachers' Planning
Children's Clothing
Food Cart Plug-in
Storage
Boys' Toilet
Girls' Toilet
C.R.
C.R.
C.R.
C.R.
Learning and Teaching Space
TV Camera etc.
to other elements of the Center

SCHEME A for

PLANNING ADAPTABLE LEARNING SPACE


Folding Partitions
C.R.
C.R.
Learning and Teaching Space
TV Camera
Toil.
Toil.
Toil
TV Camera
Toil.
Food Cart Plug-in
C.R.
Storage
C.
Conf. & Guid.
C.
Teachers' Planning
C.R.
Childrens' Clothing
Entrance - no steps or sills, so equipment can be wheeled in

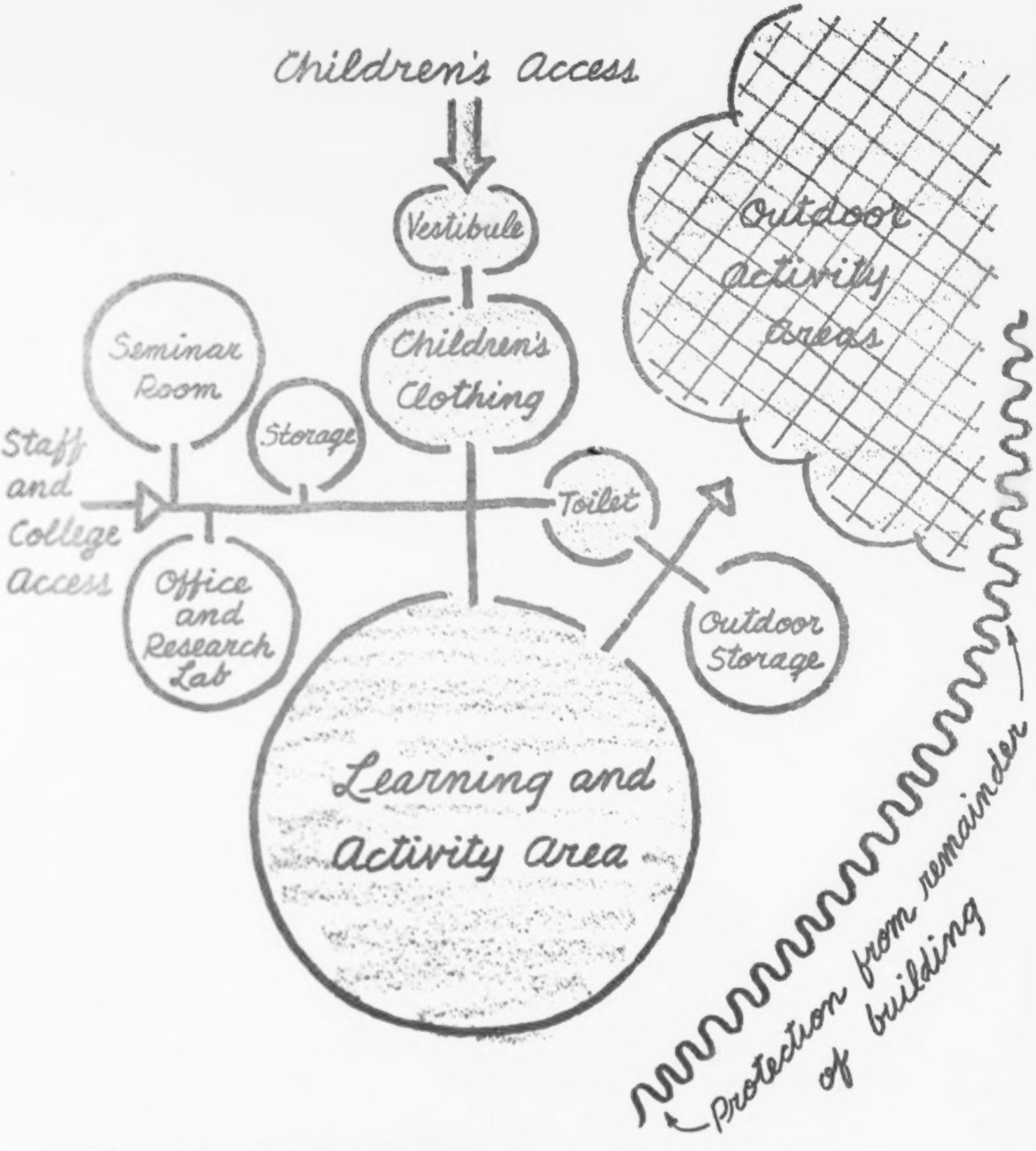
SCHEME B for
PLANNING ADAPTABLE LEARNING SPACE

closed-circuit and open-circuit television are to originate in these spaces showing various learning and teaching practices going on in the experimental Centers. Scheme B is somewhat similar, but shows a circular arrangement that would have certain advantages with core facilities, again with operable walls or folding partitions that would permit the area to be arranged in classrooms or combined into larger spaces as required.

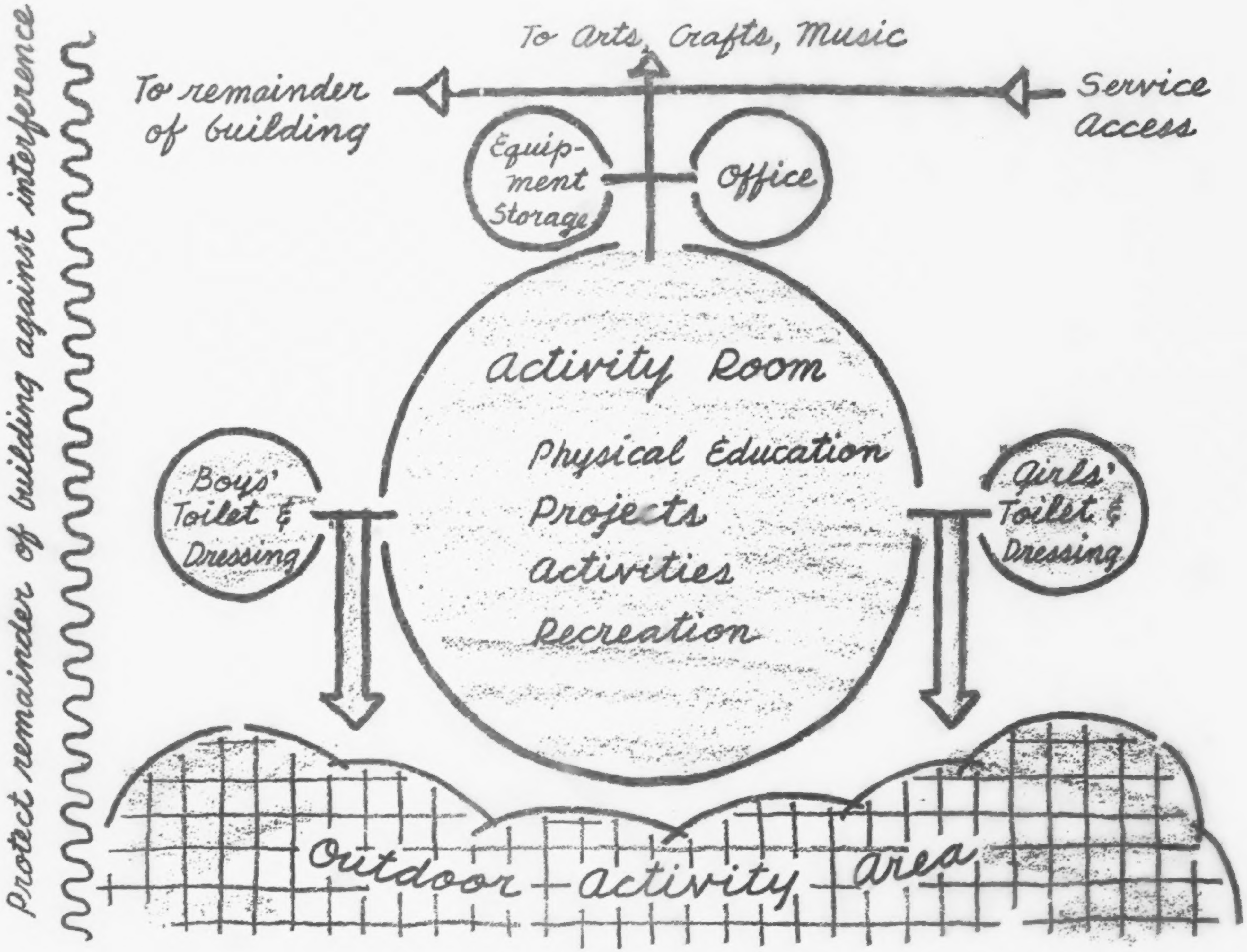
An additional schematic diagram shows space relationships of the Child Study Facility emphasizing the necessity of having a separate access and a separate play area for small children.

The activity room for physical education, projects, activities, recreation, etc., should be protected from the remainder of the building against noise and interference and should be in close proximity to the arts and crafts and the music spaces.

A memorandum used as a working paper in the Harrisburg Conference, entitled "Trends in Facilities for Elementary Education", is pertinent on the development of architectural plans for the School Children's Component. As this memorandum suggests, the concepts which have been developed for this component are not at variance with some of the most advanced practices in the provision of elementary school facilities in the United States.


Children's Access
Vestibule
Outdoor Activity Areas
Seminar Room
Children's Clothing
Storage
Staff and College Access
Toilet
Office and Research Lab
Outdoor Storage
Learning and Activity Area
Protection from remainder of building

SPACE RELATIONS-
CHILD STUDY FACILITY


To Arts, Crafts, Music
To remainder of building
Service Access
Equipment Storage
Office
Activity Room
Physical Education
Projects
Activities
Recreation
Boys' Toilet & Dressing
Girls' Toilet & Dressing
Outdoor Activity Area
Protect remainder of building against interference

SPACE RELATIONS - MULTIPURPOSE ACTIVITY ROOM

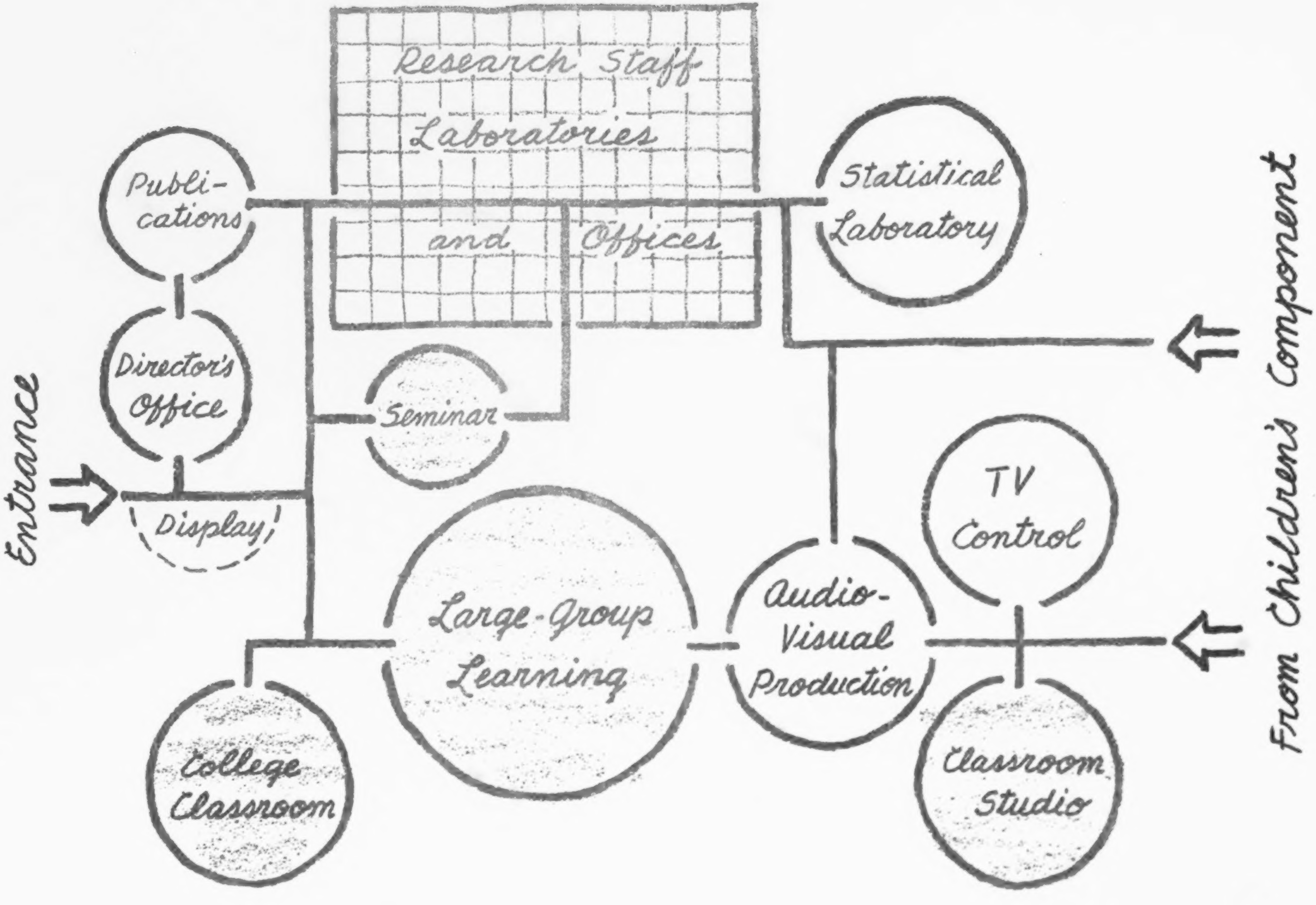
V

THE COLLEGE COMPONENT

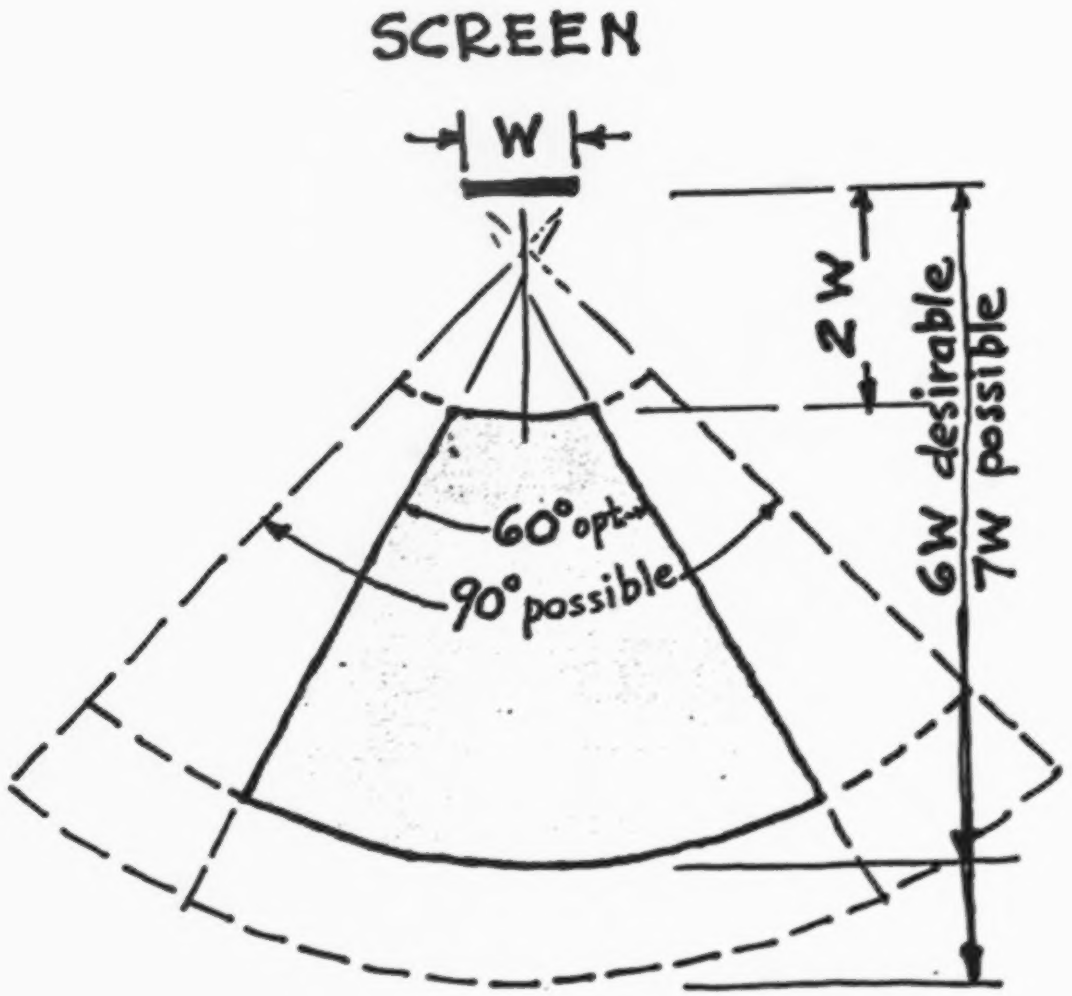
The College Component will consist of a director's office, a publications office, research laboratories and offices and some teaching space for college students. This teaching space will consist of a seminar room, one typical college classroom and a large-group learning area for the use of college students and in-service teachers from outside.

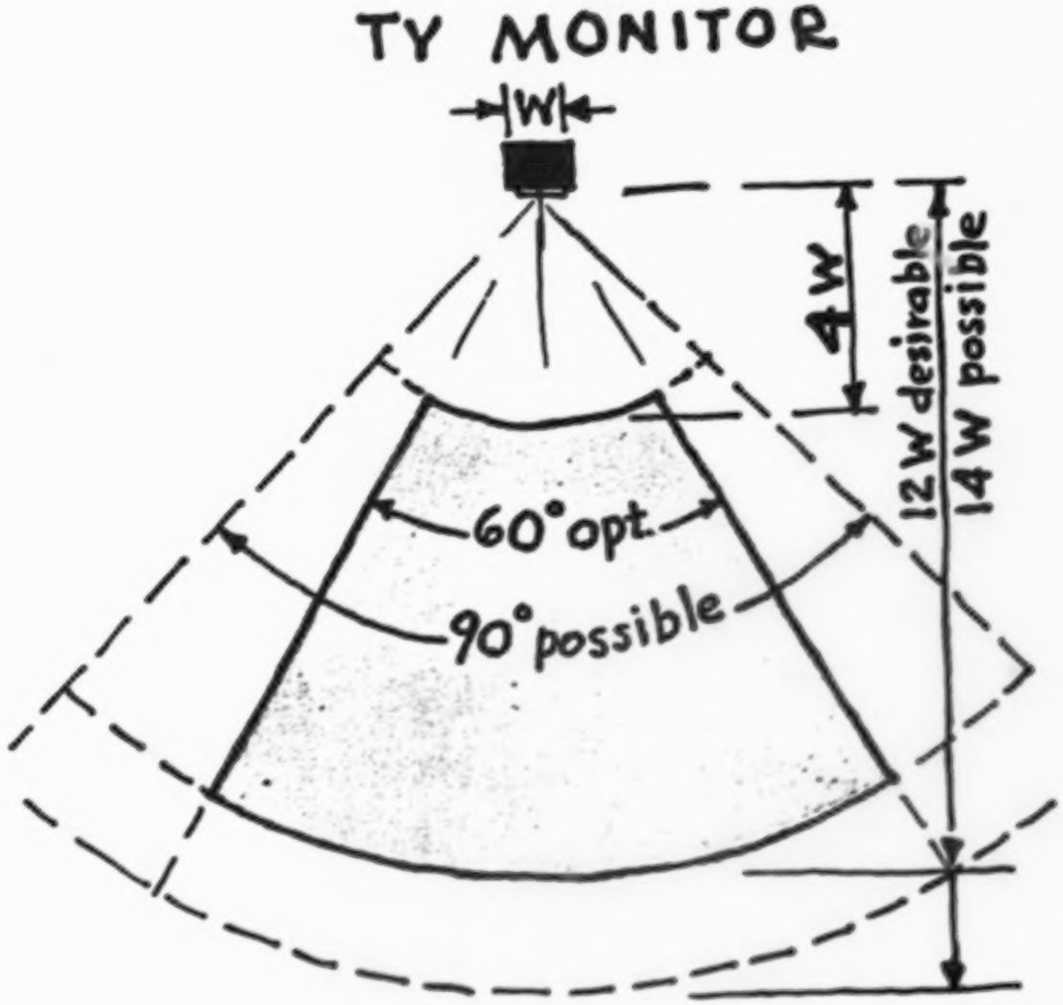
Supporting spaces are the statistical laboratory, the audio-visual production space, the TV control center and the classroom studio. These spaces are shown in relationship in the accompanying diagram.

A paper on large-group instruction space appears in the Appendix. Chapter VI discusses the educational television requirements and Chapter VII the statistical laboratory in this component.


Research Staff Laboratories and Offices
Publi-cations
Director's Office
Entrance
Display
Seminar
Statistical Laboratory
From Children's Component
TV Control
Large-Group Learning
Audio-Visual Production
College Classroom
Classroom Studio

SPACE RELATIONS - COLLEGE COMPONENT


SCREEN
W
2W
6W desirable
7W possible
60° opt.
90° possible


TV MONITOR
W
4W
12W desirable
14W possible
60° opt.
90° possible

SEATING AREA FOR VIEWING
IMAGES IS DETERMINED BY
OPTIMUM VIEWING DISTANCES
AND VIEWING ANGLES

VI

EDUCATIONAL TELEVISION FACILITIES

Ultimately, the television systems should be of the type to receive open- and closed-circuit signals in designated instructional spaces within the Learning-Research Center. It is assumed that educational television will be used in the School Children's Component of the Center experimentally and otherwise as an instructional medium. Also, it is intended that television can originate in most of the instructional spaces in the School Children's Component for transmission to teacher-training classes about the campus.

Transmission of closed-circuit television should be possible from:

1. Learning or instructional spaces in the School Children's Component of the Center.

2. A classroom-studio associated with a television control space and space for audio-visual production, including a darkroom.

Reception of both closed-circuit and open-circuit television will be expected in all college classrooms in the Center and in other college classrooms on the campus. The nature and complexity of the installation will depend upon the extent to which ETV is developed elsewhere on the campus for purposes other than those limited to the functions of the learning Centers.

Classroom-Studio

A. Space requirements

1. Ceiling height of 10 to 12 feet for overhead equipment, such as grid for spotlights and floodlights.
2. Flexibility for originating various telecasts, lectures, demonstrations, teaching methods of various sorts for groups of as many as 35-40 pupils.
3. Large doors for moving equipment.
4. Location near control room and audio-visual production space.
5. Storage space for various types of teaching and classroom desks, chairs, etc., and studio production materials.

B. Lighting and electricity

1. Capable of 10-500 foot-candles of instant illumination.
2. Spotlights and floodlights.
3. Proper shielding of units likely to interfere with audio system.
4. Wiring for equipment other than lights. Wiring may be needed for instructional electronic equipment at pupil stations.

C. Heating and ventilating

1. To maintain temperatures of 68 to 72 degrees Fahrenheit.

2. Minimum noise level from fans or ducts.

D. Sound control

1. Sound absorptive materials on floor, walls, ceiling. Flooring of cork or carpeting.

2. Good listening conditions.

3. Protection from outside noises.

TV Control Room

This area will house control equipment and personnel to operate it. It is the nerve center for receiving and coordinating both remote and studio signals.

Features include:

Ceiling height of nine feet sufficient

Wiring of sufficient capacity for type of equipment to be installed

Air conditioning to control heat output of electronic apparatus

Acoustical treatment and separation from external noise sources

Location adjacent to spaces into which it may be expanded

Audio-Visual Production Space

This space will serve not only the ETV programs originating through the Learning Center but other types of audio-visual production, charts, displays, film strips, motion pictures, etc.

Its features should include:

Adjacent office space for at least three faculty staff and assistants

Ample work space for art work and graphics, models, sets, apparatus

Materials storage for films, tapes and materials maintenance space for mending and repairing such materials

Space for previewing films, etc.

Darkroom for limited photographic processing. This will be used by entire Learning Center staff for various research and teaching operations requiring photography

Space for repairing equipment

Toilet facilities and make-up and dressing space

Equipment for TV

A. In spaces where children are learning

1. Convenient receptacles in spaces equivalent to classroom spaces used for learning and teaching, the Child Study Facility, Resource Center, Individual Study Center, large-group learning space, activity room, arts and crafts room and music room

for originating and receiving.

2. TV monitors, 24-inch, both ceiling-hung and portable.

B. In learning spaces for student teachers (college)

1. In conventional classrooms, 24-inch TV monitors.

2. In large-group spaces for college classes, choice of rear-screen or front-screen projection of TV should be considered.

C. In classroom-studio

1. Cameras concealed in walls and provisions for mobile cameras.

2. Separate camera control unit for control and deflection of voltage.

3. Lenses as required.

4. Intercommunication system to master control.

5. Audio equipment -- desk and ceiling-mounted microphones.

D. Basic equipment (either in Center or elsewhere on campus)

1. Master antenna system for both VHF and UHF reception and FM radio reception.

2. Separate channel preamplifiers for each station to be received.

3. Converter for local UHF television.

4. Facilities for projection of 16 mm silent or sound film, 2" x 2" slides and 35 mm film strips on CCTV system.

5. Vidicon cameras for use in individual classrooms for demonstrations.

6. Video monitors and audio console controls for television and intra-communication, including PA system.

7. Miscellaneous test equipment (oscilloscope, wave generator, volt meters, tube testers, etc.).

E. In audio-visual production room

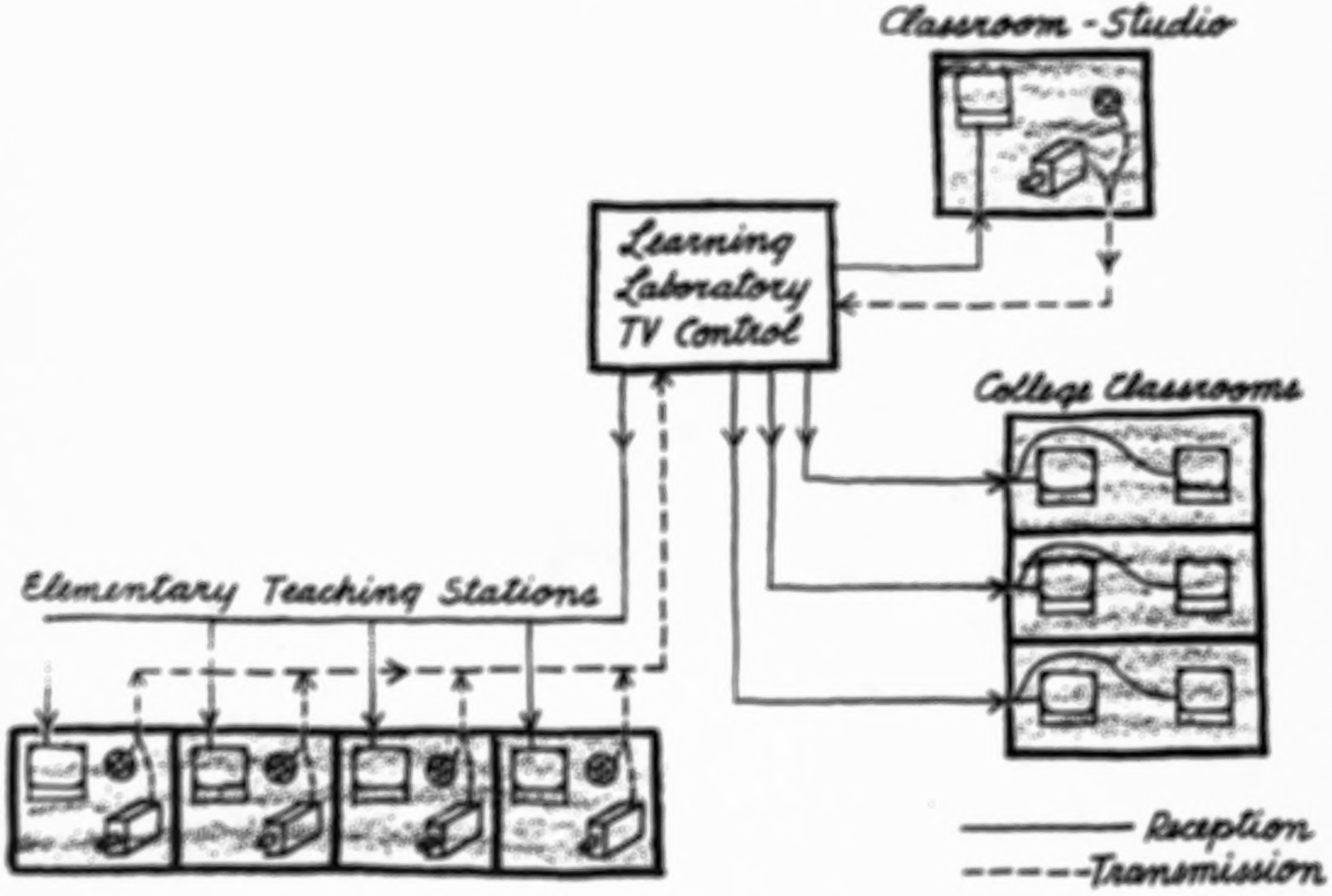
1. Photographic equipment -- enlarger, contact printer, 35 mm camera, developing facilities.

2. Printing and reproducing -- photocopy machine for copies and transparencies for overhead projectors, sign making and poster making equipment.

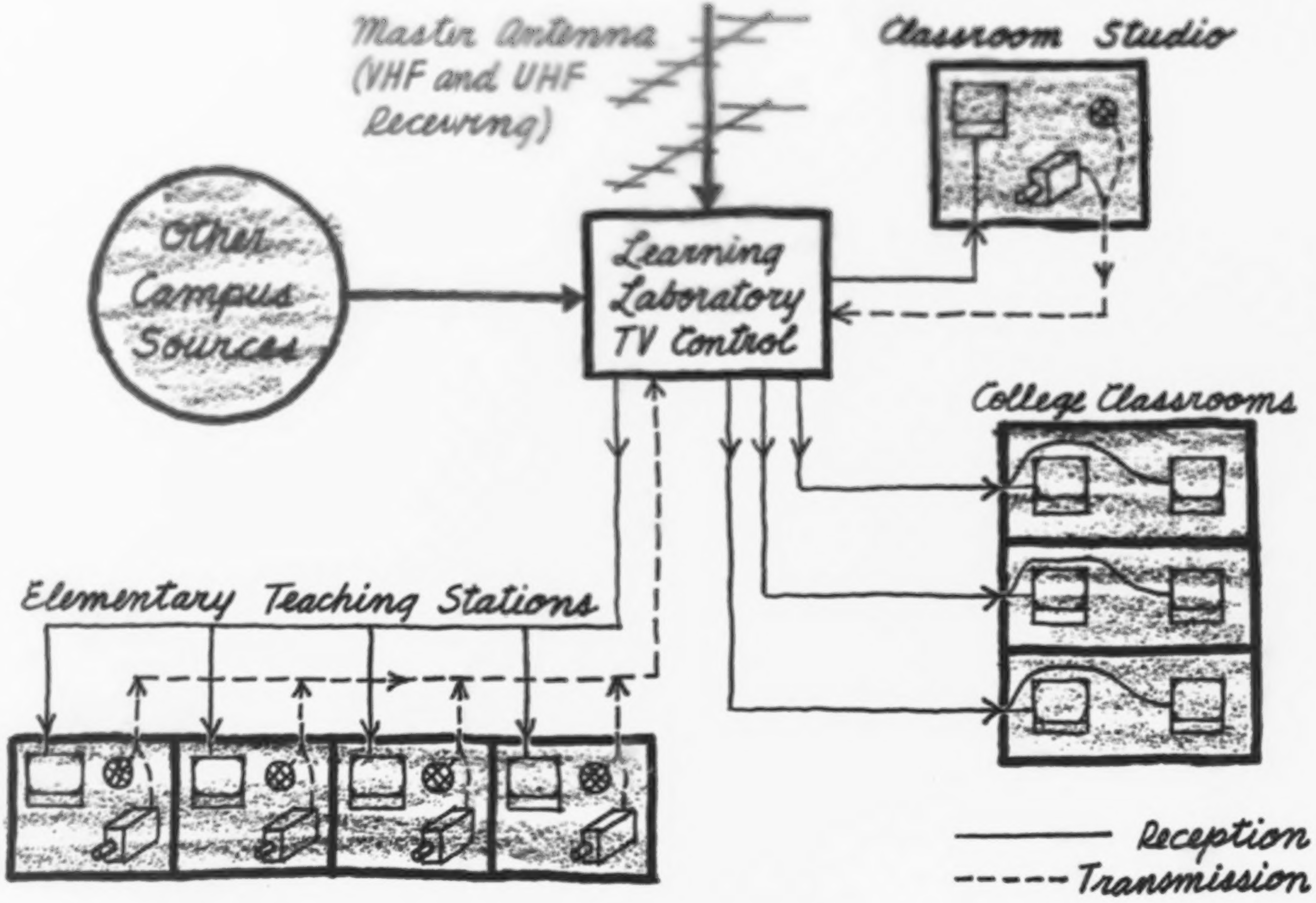
3. Projectors -- motion picture, film strip, slide, opaque, overhead, micro.

4. Miscellaneous audio -- tape recorders, record players, radios, portable PA equipment.

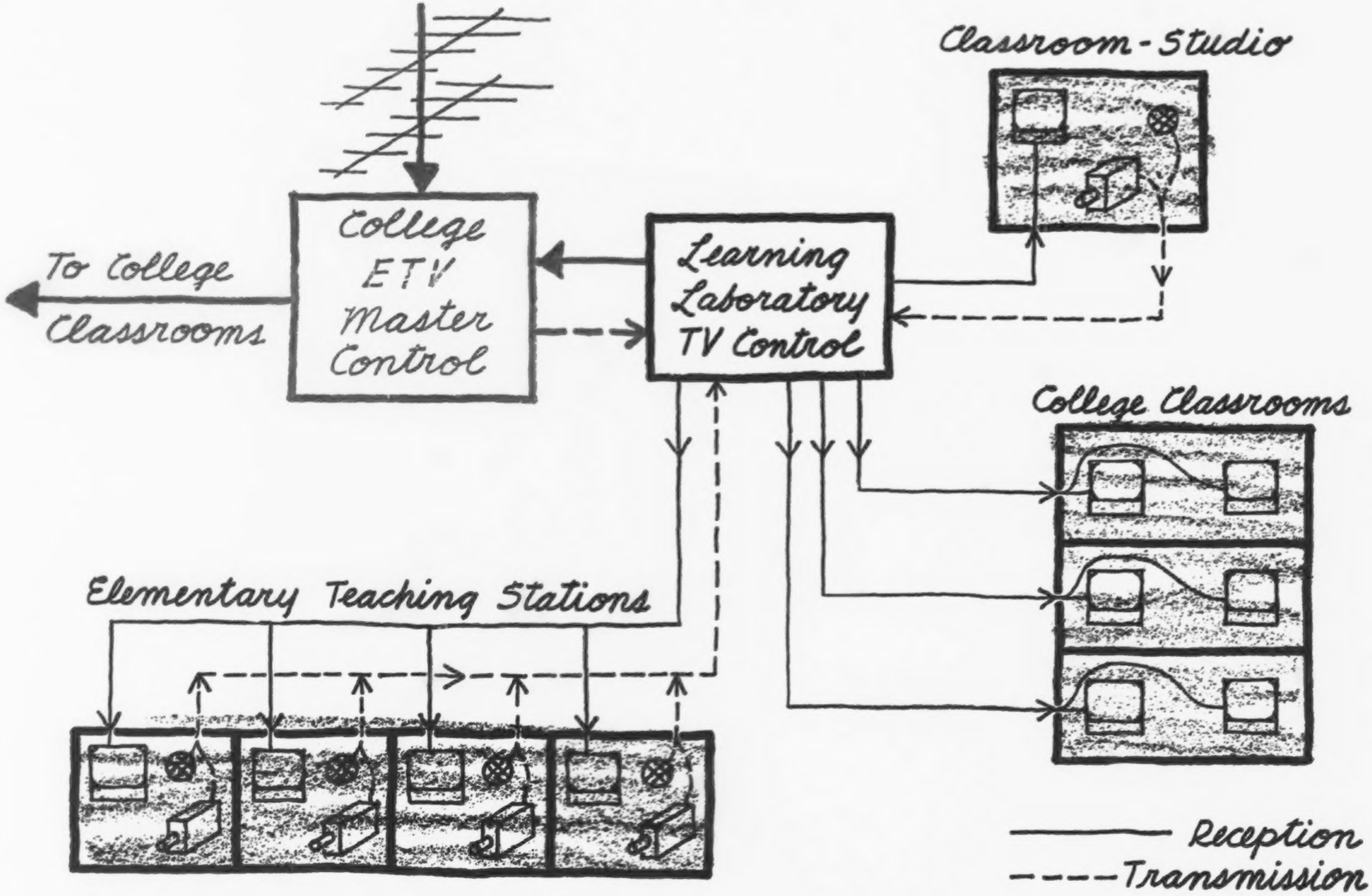
5. Accessories -- portable screens, projection tables and stands, portable lighting equipment, teaching machines, easels, work tables, flannel and magnetic boards, maintenance equipment, drawing tables.


Classroom - Studio
Learning Laboratory TV Control
College Classrooms
Elementary Teaching Stations
Reception
Transmission

CLOSED CIRCUIT TV ONLY - MINIMUM INSTALLATION


Master Antenna (VHF and UHF Receiving)
Classroom Studio
Other Campus Sources
Learning Laboratory TV Control
College Classrooms
Elementary Teaching Stations
Reception
Transmission

CCTV WITH OPEN CHANNEL RECEPTION AND OTHER SOURCES


Classroom - Studio
College ETV Master Control
To College Classrooms
Learning Laboratory TV Control
College Classrooms
Elementary Teaching Stations
Reception
Transmission

CCTV AND HOOK-UP WITH COLLEGE MASTER ETV CONTROL

VII

STATISTICAL LABORATORY

Technological development of electronic equipment for data processing and knowledge gained through applications of automation in industry greatly enhance the potentialities for efficient means of analyzing data essential to educational research and experimentation. A school operation in the years ahead will inevitably find it economical to have electronic data processing equipment merely for routine management purposes. Many elementary and secondary schools, most universities, large colleges and many small colleges are now finding it desirable to install modern facilities for record keeping, recording, accounting and management.

It is even more important that a facility which is to be experimental in nature and which will engage in research should plan to have this type of equipment available. Moreover, the type of equipment which is to be installed in an experimental center should be determined with considerable flexibility -- both because technological developments can produce many new and useful pieces of equipment and because an experimental center should be in a position to demonstrate equipment of this type somewhat ahead of its adoption in general educational practice.

At the time of detailed working drawings and specifications of a new building it is desirable to study specifically the kind of processes to be required and specific types of equipment. At that time it is advisable to consult various manufacturers of such equipment. They are equipped to supply detailed information necessary for suitable layout and installation of same.

Types of Equipment

Basically the types of equipment which would be installed in an experimental center include the following:

1. Input machines. Card punch machines, verifiers, reproducers, interpreters

2. Manipulating machines. Sorters for arranging cards in desired sequence, collators for matching up cards as required, summary card punchers for producing summaries of groups of cards

3. Output machines. These include tabulators or counting machines and calculating punchers

Other types of equipment are required in educational research as source material to feed this data processing system. Chief among such pieces of equipment are test scoring machines, an essential item in any serious program of educational research.

It is assumed that a minimum of equipment will be available in the statistical laboratory. As the function of the learning Centers develops fully and as the nature of the research and demonstration becomes more sophisticated, it is expected that more equipment will be required -- equipment that can be used not only for data processing, but which can be used for experimentation and instruction where automation can replace much of the routine of teaching. Exploratory work is now being done using electronic computers for storing information and automatically providing for individual students or for groups audio and video materials, either on a preselected or randomly arranged basis, or paced to suit requirements of instruction. Complex computer-based instrumentation for learning and teaching shows that it is feasible to regulate learning by storing stimulus materials with a pattern or with random access, by recording data on learning or responses as they take place, by immediately informing students and teachers of results, and processing and summarizing rapidly the course of learning and the effectiveness of instruction.

For such reasons the installation of statistical equipment in the Centers should be considered subject to expansion and modification over the years.

The minimum of items to be housed in the statistical laboratory include the following:

2	Card punch or key punch machines
2	Card punch verifiers
1	Tabulator (accounting machine)
1	Reproducing punch
1	Collator
1	Calculating punch
2	Test scoring machines
2	Desks
2	Work tables
	Card files, hand calculators, adding machines

This equipment, with the area required around each machine to service it properly and safely, would require alone about 600 square feet. With proper office space, access areas and suitable separation of functions with required storage, a minimum of 1,200 square feet would be required.

Special Considerations for the Housing of Statistical and Data Processing Equipment

The arrangement of space for the statistical laboratory should take into account required structural environmental conditions and the safety and convenience of personnel who are to make use of the equipment. The following items are special considerations to be taken into account by the architect in his planning:

1. Ample provisions for specific items such as those outlined above, plus other types of equipment such as chairs, storage cabinets, control-panel storage racks, form stands, etc.
2. Grouping of machines in the installation to provide for convenient work flow.
3. Provision for future expansion.
4. Adequate floor-loading capacity. Fifty pounds per square foot is considered adequate.
5. Convenient access to area for equipment and those to use it. Doorways, elevators, etc., must be such as will accommodate heavy machinery.
6. Air conditioning must take into account the heat dissipation ratings of machines. These are available in BTU's per hour from manufacturers. For inadequate cooling systems more advanced equipment sometimes requires forced-air exhaust systems. This should be anticipated. Humidity control is as important as temperature control. Dry air creates excessive static

electricity. Humid air affects punch cards and their processing. Temperature should be maintained at between 70 and 80 degrees Fahrenheit and relative humidity at about 50 percent.

7. Storage and file facilities, in addition to the usual office files and card-storage cabinets, include control-panel racks, carts to transport card-file drawers, cabinets for storage of paper forms and tapes and benches or desks for purposes of wiring control panels.

8. Proper operation of equipment requires line voltage not exceeding ten percent of rated voltage plus or minus. Adequate receptacles equipped with ground prongs are necessary in keeping with the rated current of the respective machines to be used. As much as 100 amperes of electricity might be needed.

9. Location of the space in the building should be where it is not subject to excessive vibration.

10. Minimum light intensity of 40 foot-candles measured at 30 inches above the floor is recommended.

11. Walls and ceiling need acoustical conditioning for the efficiency and comfort of personnel working in the facility and to prevent the transmission of noise to adjacent areas.

12. There should be provision for more than one access to the room.

13. The area should be constructed of fire resistive material and not adjacent to areas where flammable or explosive gases or materials are handled.

14. Forms, paper tape, cards, etc., should be enclosed in metal cabinets or fire resistive containers for reasons of safety.

Glossary of Terms Related to Data Processing

Key Punch or Card Punch. -- A machine that punches holes in cards.

Verifier. -- A machine on which punch cards are reprocessed to determine whether or not they have been properly punched.

Reproducer. -- A machine which "reads" information punched on one card and automatically punches the same information on the next card.

Interpreter. -- A machine which translates coded information punched in holes in a card into printed characters on a card.

Sorter. -- A machine which reads coded information on cards so that they can be sorted into decks or categories.

Collator. -- A machine which matches two sets of cards so that when there is more than one card per unit of statistical analysis the two can be merged and matched.

Summary Card Punch. -- A machine which reads many cards and punches out on one card totals of data.

Accounting Machine or Tabulator. -- A machine capable of addition, subtraction and simple multiplication which reads punched holes in cards and produces a printed record on tape.

Calculator. -- A high-speed multiplier and divider which works with punch cards.

VIII

SPACE REQUIREMENTS

It is expected that the actual construction planned on each campus will be adapted to the character of the experimental program, the nature of existing facilities and available site.

The Basic Requirement

The basic requirement in spaces by square feet of floor area follows.

		Square feet of floor area
SCHOOL CHILDREN'S COMPONENT		
2 Learning Spaces, each consisting of:		
Equivalent of four classrooms in flexible, combinable or separable area with movable storage	4,800	
Teacher planning room	600	
Conference and guidance room	150	
Storage and workroom	200	
TV and audio-visual equipment room	100	
Total, each learning space	5,850	
Learning Spaces Total		11,700

SCHOOL CHILDREN'S COMPONENT (Cont'd)

		Square feet of floor area
Resource Center (Pupils')		
Library reading area, pupil research and book storage	850	
Audio-visual equipment storage	200	
Office and workroom	150	
Individual study spaces	400	
Resource Center Total		1,600
Arts and Crafts Room, with storage (convertible to other uses)		750
Music Room (convertible to other uses)		750
Multi-Purpose Activity Room		
Activity area	4,000	
Storage	200	
Toilets and dressing	800	
Multi-Purpose Room Total		5,000
Administration		
General office	400	
Principal's office	200	
Conference room	300	
Health room	400	

			Square feet of floor area
SCHOOL CHILDREN'S COMPONENT (Cont'd)			
Administration (Cont'd)			
	Storage and records	250	
	Teachers' rest rooms	600	
Administration Total			2,150
TOTAL NET AREA, SCHOOL CHILDREN'S COMPONENT			21,950
COLLEGE COMPONENT			
Offices			
	Director's office	200	
	Publications office	400	
	Reception area and secretarial space	450	
4	Research offices at 110 square feet each	440	
2	Research laboratories at 250 square feet each	500	
Offices Total			1,990
Learning Spaces			
	Seminar and conference room	400	
	Large-group learning room with presentation area and supporting audio-visual spaces	3,200	
Learning Spaces Total			3,600

		Square feet of floor area
COLLEGE COMPONENT (Cont'd)		
Audio-Visual Complex		
Audio-visual production laboratory	1,600	
ETV control center	400	
Classroom studio	1,200	
Audio-Visual Total		3,200
Statistical Laboratory		1,200
TOTAL NET AREA, COLLEGE COMPONENT		9,990
GRAND TOTAL NET AREA		31,940
Additional spaces for walls, corridors, storage, toilets, custodial space, mechanical equipment, etc.		14,000
ESTIMATED GRAND TOTAL GROSS AREA		45,940

Alternative Plans

As the basic requirement is adapted to individual campuses, several modifications of the above may be expected. For instance, the requirement for audio-visual facilities may be reduced on a campus which is planning advanced ETV facilities for general college purposes capable of serving the needs of the Center.

A college which schedules an experimental program not requiring more than 100 pupils or so might choose to construct only one of the two Learning Spaces in the School Children's Component. In lieu thereof, its emphasis might require a Child Study Facility consisting of approximately 2,000 square feet of net floor area -- 1,400 square feet as learning and activity space, 300 square feet as staff office space and 300 square feet for storage and equipment.

The basic requirement calls for an arts and crafts room and a music room. These auxiliary rooms may be expected to serve various purposes from college to college and from time to time on the same campus.

IX

CHECKLIST OF SPECIAL FEATURES

General

1. Locate building on site for optimum use of outdoor spaces.

2. Orient learning spaces for cheerful natural light, but guard against extreme sun and sky glare. Minimize fenestration, in keeping with requirements of (a) room darkening for audio-visual instruction, and (b) heat loss.

3. Air condition entire structure. This suggests a compact design.

4. Locate service entrance at one point, without pedestrian cross-traffic or interference with outside play areas.

5. Parking areas and bus loading facilities should be provided.

6. Provide paved multi-use areas for play, combined with overflow parking.

Learning Spaces

1. Ceiling heights minimum with respect to area of spaces.

2. Evenly distributed, glare-free light.

3. Public address system.

4. Clocks in all educational rooms.
5. Light switches at doors.
6. Working heights appropriate to young children in School Component.
7. Adequate duplex electrical outlets.
8. Acoustic control.
9. Adequate ventilation.
10. Ample tackboard.
11. Movable chairs and tables.
12. Flag holders.
13. Lavatory and toilet convenient for supervision by teacher.
14. Display rails for maps.
15. Drinking fountains nearby.
16. Ample storage for variety of instructional materials.
17. Storage for outdoor clothing. Consider movable alcoves or wardrobes with undivided open lockers, low shelf for rubbers and hook for hat and coat for flexibility.

18. Plan tackboard and pegboard on movable storage walls for flexibility.

19. Teachers' work spaces and storage.

20. Bookcases and reading areas in School Children's Component learning spaces. Book trucks should be used to transport books from Resource Center.

21. Pylons with utilities for food carts from kitchen.

Resource Center

1. Book storage, reference and research.

2. Open stacks so pupils can easily get books.

3. Tables and chairs in alcoves with visual control from desk.

4. Equipment to include charging desk, tables and chairs, catalog cases, book trucks, dictionary stands, magazine racks, filing cases, ample display cabinets, shelving standard 8-inch and ten-inch.

5. Conference and workroom with sink, shelving, electrical outlets.

6. Viewing and listening in adjoining Individual Study Center or carrels located in Resource Center positioned for supervision.

7. Storage for audio-visual equipment and materials -- charts, maps, slides, film strips, films, tapes, projectors, recorders, record players, screens.

Activity Room

1. Should be planned for hard use.
2. Acoustic treatment essential and properly isolated from other learning spaces and quiet areas.
3. Good air circulation needed.
4. Orient to avoid sunlight. No windows preferable.
5. Direct access to out-of-doors and minimum of disturbance of passage from out-of-doors to other areas.
6. Platform or stage at one end for music and dramatic presentations. Simple facilities for spot lighting and curtains.
7. Recessed and protected places for piano, record players, recorders, etc.
8. Storage for chairs on movable trucks to seat 250.
9. Storage rooms for indoor and outdoor play equipment.

10. Screen for projection.

11. Drinking fountains

Offices

1. Minimum faculty office 110 square feet single, 200 square feet double.

2. Research personnel with assistants, work tables, clerical help and files should have 200 square feet minimum

3. Avoid secondary corridors, open bays, and long, narrow offices.

4. Design office areas, if possible, in modules for combination of units to provide reception areas, conference rooms, secretarial spaces, etc.

5. For flexibility consider use of bookshelves and storage walls to partition office spaces.

6. Avoid partitions short of ceiling.

7. Have convenient toilet facilities nearby

8. Separate noise of typewriters, calculators, etc. from conference rooms and private offices.

9. Proper acoustical control.

10. Good lighting (30 - 50) foot-candles, glare free, low contrast -- outlets for special local lighting.

11. Outlets for equipment.

12. Air conditioning.

APPENDIX

ERS Educational Research Services inc. SCHOOL AND COLLEGE CONSULTANTS 7 HOLLAND AVENUE / WHITE PLAINS, NEW YORK

BASIC QUESTIONS TO BE ANSWERED IN DETERMINING FACILITIES FOR STATE COLLEGE EXPERIMENTAL CENTERS IN PENNSYLVANIA

Harrisburg, Pennsylvania Conference - October 23 and 24, 1962

PART I - FUNCTIONS AND ACTIVITIES

The general approach of this discussion guide is that of determining specific facilities on the basis of the functions to be served. This section raises several questions concerning the five possible functions or basic purposes of the Centers.

A. As Related to Training of Teachers (Pre-service and In-service)

1. Will the facility be used for demonstration teaching, specific demonstration lessons? If so, how and to what extent (e.g., in weekly hours)? What will be the size of groups for which demonstration teaching is required and how frequently during the year will they meet? In what areas of the curriculum and for which grade levels will it be required?

2. Will the facility be used for observation, i.e., classroom visits other than required for scheduled demonstration teaching? What will be the scope of this observation?

3. Will the Center be used for practice teaching? If so, to what extent?

4. Will the Center be used for practice in training for educational personnel other than teachers, such as: psychometricians, guidance personnel, reading specialists, etc.?

5. Will some college classes be scheduled in the Center itself? If so, what types and to what extent?

6. What administrative personnel, if any, such as supervisors, principals, will in any way receive training in the Center and how?

7. Will the Center be used for workshops and conferences for in-service teacher training?

8. Will the Center have responsibilities in any manner for extension classes?

9. Will the Center serve as a means of communicating with in-service teachers as regards their training?

B. As Related to Field Services

1. Will the Center engage in surveys of local school systems? If so, what type and to what extent?

2. Will the Center administer, score and tabulate the results of tests?

3. Will the Center provide for special education services? If so, what types and to what extent?

4. What, if any, clinical services will be provided at the Center (*e.g.*, guidance, remedial reading, speech therapy, etc.)?

5. Will the Center be engaged in special consulting services for school systems? If so, what types and to what extent?

6. Will the Center provide technical assistance for school systems in undertaking research and experimental programs? If so, of what nature?

7. Will the Center provide data processing services for school systems in connection with business operations and statistical reporting? Research and evaluation?

8. What staff will be assigned the Center, if any, for such purposes and what will their duties be?

C. As Related to Research and Experimentation

1. Will the Center be engaged in basic scientific research not directly related to education (e.g., a study of properties of number systems, or effects of body chemistry on emotional states)?

2. Will the Center undertake basic research related to education (e.g., comparative efficiency of learning under various conditions, or studies of concept formation of children)?

3. Will the Center exist primarily for classroom experimentation -- that is, operating as a laboratory school in one sense of the term -- or as a pilot school for experimental tryout and initial revision of new curricular materials and instructional methods?

4. Will the Center undertake field testing or "tryout" of curricular materials and instructional programs developed through experimentation either within the Center or elsewhere?

5. If research and experimentation are primary functions, to what degree are all of the instructional activities in the Center to be thus oriented?

6. What will the relative emphasis be among the four types of research and experimental activities indicated in questions 1-4 above?

7. To what degree will the research activities of the Center require subjects in the Center itself, vs. subjects in other schools?

8. By what mechanisms are research and experimental projects for the Center to be selected and what are the mechanisms for determining their duration?

9. Are experimental programs to be limited exclusively to those for which there is systematic evaluation or may some of them become simply exploratory in nature?

10. How will research personnel be assigned to the Center? Will there be full-time research staff? Will faculty participate part-time? Will there be sub-professional and

technical personnel assigned and graduate assistants assigned in the research and experimental work?

11. Will there be a principal of the elementary instructional activities of the Center? If so, what will the principal's relationship be to the research program and determination of what activities are undertaken in the "school"?

D. As Related to Area Demonstration and Development (Promotion of Improved Educational Practices in the Geographic Area Served by the Center)

1. Will it be the purpose of the Center to operate as an example or demonstration of improved educational practices? Does this mean that it is to be a "model school" or simply a center for demonstration of specific practices?

2. By what methods are exemplary practices in the Center which are to be demonstrated communicated to public schools in the environs of the Center? Will the Center organize conferences and workshops for groups of teachers in school systems in the neighborhood? Will the Center conduct a publication program for communicating to nearby school systems? Will radio and television be used to diffuse ideas generated in the Center?

3. Will the Center serve as a clearing-house for the diffusion of information regarding educational innovations other than those generated within the Center itself?

4. Would the Center contain collections of curricula, instructional materials, teaching aids, etc., to be used by teachers in the field as a resource and information center?

E. As Related to the Operation of an Elementary School

1. For the various functions indicated above, is it necessary to have a complete Kindergarten through sixth grade elementary program?

2. Is it to be the intent to have the Center a source of experimentation and demonstration of a "model school", or rather experimentation and demonstration of educational

innovations if, as, and when there is either new knowledge to be developed or there is enough knowledge to justify tryout and development?

3. From what sources are pupils to be drawn?

4. Are pupils and grades in the school to change from time to time depending upon the particular research, experimental or demonstration objectives?

5. How will the instructional program on the elementary level in the Center be related to neighboring public school systems?

6. To the degree that there are regular, formal classes operating in the school, what types of personnel will be used for teachers in them? Will they be shifted from time to time, depending upon the experimental program? Will there be some classes for teacher training and others for experimentation, or will they all be of one type or another?

7. What months during the year will instruction take place in the Center on the elementary level?

8. Will there be any selection of pupils other than by age or grade?

F. Balancing Objectives

1. Of the five categories of objectives -- A, B, C, D and E above -- what should their relative rank be in determining the program of the Center?

2. In what respects will any of the five functions or objectives be inconsistent with one another in the planning of the Center?

3. What principles or practices are suggested to reconcile such conflicts?

4. In what respects will the accomplishment of any of the five major categories of function for the Center call for coordination with other parts of the college? In what ways may this coordination be brought about?

5. Are there functions or aspects of functions not previously indicated which should be considered in the planning of the Centers?

PART II - FACILITIES REQUIRED

It is assumed that specific facilities for the Center should be determined only on the basis of functions to be served. This appears to be a straight-forward analysis. For instance, if it is decided to have third-grade classrooms and to have experimentation in such classrooms, a decision is required as to how many classrooms and what some of the features of such rooms will be for classroom experimentation. However, there are many ambiguities.

It is impossible to determine in detail, in advance, all of the types of educational experiments, innovations and demonstrations which might become important projects for the Centers. The Centers presumably will be in operation for many years to come, so that decisions about specific facilities to be required must depend upon considerable judgment. Nevertheless, it should be obvious that the nature of the facilities, at least in broad terms, certainly will depend upon the definitions of functions discussed in Part I and their translation into an operating program.

The following outline is schematic. After each of the items are five columns, one for each of the five major functions. In effect, this is a questionnaire in that we ask for each type of space a question concerning its desirability relative to each of the five possible uses or functions. For instance, the item dealing with classrooms, elementary, really is a question in which it is asked: "In view of the teacher training function, the field services function, the research function, the promotion function and the elementary educational function, what elementary classrooms will be required? How many and what kind?"

If, for example, it is determined that all of the teacher training requirements and promotion requirements are satisfied by operating classrooms only for research or experimental purposes, then only those classrooms required for research and experimental purposes will be necessary unless it is also decided that a function of the Center is to be that of a pilot or model school. In that case, it will be necessary presumably to have all age and grade levels of an elementary school.

	Teacher Training	Field Service	Research and Exp.	Promotion	Elementary School
Building Features					
Design concept					
Organization					
Space relations					
Zoning					
Circulation					
Structural features					
Environmental requirements					
Display areas					
Services					
Miscellaneous					
Other					
Spaces					
Classrooms, elementary					
Classrooms, nursery					
Classrooms, Kindergarten					
Classrooms, special					
Classrooms, college					
Large-group instruction, elementary					
Large-group instruction, adults					
Conference rooms					
Seminar rooms					
Workrooms					
Research laboratories					
Offices, school principal					
Offices, research					
Offices, faculty					
Offices, clerical					
Work space, data processing					
Testing centers					

	Teacher Training	Field Service	Research and Exp.	Promotion	Elementary School
Spaces (cont'd)					
Document storage space					
Publications, editorial					
Publications, duplicating					
Library, college					
Library, elementary curricular					
Library, pupils					
Audio-visual spaces					
Teacher planning areas					
Cafeteria					
Auditorium					
Darkroom					
Health suite					
Physical education spaces					
Music rooms					
Art rooms					
Science rooms					
Shops					
Home making					
Other					
Site					
Location					
Orientation					
Size					
Access requirements					
Outdoor educational space					
Location of building					
Landscaping					
Space relations					

	Teacher Training	Field Service	Research and Exp.	Promotion	Elementary School
Site (cont'd)					
Other					
Furniture and Equipment					
Classroom seating, elementary					
Classroom seating, adult					
Movable desks and tables					
Chalkboard					
Tackboard					
Work sinks					
Counters					
Built-in work or study tables					
Supply and book storage					
Clothing storage					
Test scoring equipment					
Data processing equipment					
Calculators					
Office equipment					
Duplicating and printing equipment					
Lounge furniture					
Cafeteria furniture					
Special clinical equipment					
Musical instrument storage					
Industrial arts equipment					
Physical education equipment					
Homemaking equipment					
Art equipment					
Typewriters					
Teaching machines					
Stage equipment					
Classroom demonstration tables					

Furniture and Equipment (cont'd)

	Teacher Training	Field Service	Research and Exp.	Promotion	Elementary School
Motion picture equipment					
Projectors					
Microfilm readers					
Tape recorders					
Language laboratory equipment					
Record players					
Television receivers					
Closed-circuit TV equipment					
Radio receiving equipment					
Radio transmitting equipment					
Photographic equipment					
Graphic arts program preparation equipment					
Public address system					
Special instructional devices (e.g., tachistoscope)					
Other					

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SOME EDUCATIONAL IMPERATIVES AND THEIR IMPLICATIONS FOR ELEMENTARY SCHOOL FACILITIES

The design task in planning a facility for a Center in which there is to be learning and research in elementary education is to provide a suitable enclosure for spaces which are to accommodate human behaviors -- thoughts, feelings and actions -- of children of elementary school age and teachers and other personnel working with these children.

The prime consideration which must override all others in the planning of the structure, at least with reference to the elementary school function, is the creation of an environment for learning from the perspective of the children for whom it is to be used in the complex processes of living and learning.

It is thus important to consider some of the accumulating ideas about the learning process along with the growing knowledge about features of a satisfactorily compatible physical environment for formal education.

Some Implications for Good Education

The following principles and their implications should help build a blueprint of the general features of human behaviors for which a good school building must be designed.

1. Children do not learn from a lecture or a book -- they learn only from what they do. They write to learn to write, spell to learn to spell, speak to learn to speak, etc. This implies activity -- some physical, some purely mental, some vicarious experience, some real life experience -- but active, not passive experience. Activities include: planning, deciding, analyzing, discussing, selecting, making, collecting, organizing, searching, reading, listening, watching, constructing, drawing, designing, practicing, displaying, speaking, reporting, storing. Newer techniques of programmed instruction make use of this principle in requiring the learner to do something (write a word, push a button on a teaching machine) at the presentation to him of each bit of information.

2. There are vast differences among pupils of the same age in an infinite variety of personality and intellectual characteristics related to formal school work. These include rates of learning various subjects, interests, how they fit into the social situation of the classroom group and individuals in it, their views of the teacher, their conceptions of self in relation to authority, their capabilities of adapting and adjusting to new situations, their physical and emotional well-being, their readiness for a specific learning at a specific time, etc.

The implication is that efficient learning in a school situation requires a great variety of types of learning experience. Moreover, spaces must be such that learners may be doing many different kinds of things at a given time. As all teachers know, even if a given class group is listening to a lecture or viewing a film (or TV) -- all at the same time -- what they are doing, in the intellectual sense, is not the same. Test results show great differences in what they learn. At the lecture or the film showing some are bored, others are fascinated -- some understand, others do not -- some are attentive, others daydream, etc.

All this means continuous re-examination of the degree to which the various devices and attacks upon teaching are effective in producing the desired outcomes for a particular group and the individuals in it. Good teaching requires a continuous adaptation of teaching methods to the characteristics of the learners. The approaches vary from individual counseling or tutoring to large-group presentation. The materials of instruction vary from time to time, from class to class, and subject to subject, but the textbook is not the sole medium of communication in teaching.

A further implication of this principle is the necessity of conveniences for many activities in which teachers must engage so that the progress of individual students may be determined, their intellectual, physical, social and other problems known and the proper remedial or other course of action prescribed.

For these reasons teachers need:

Places to store a wide variety of instructional devices

Places for consulting with other teachers concerned
with the same student or group

Places for counseling of individual students

Places for group and individual testing

Places to file records on progress and characteristics of individual pupils

3. Learning is more efficient and more effective if learners experience success more often than failure. This calls for skillful teaching, but also a physical environment which encourages learning. Primitive notions that creative talents are engendered by the tough school of "hard knocks" have not been borne out. Even in types of military training it has been shown that subjects learn more quickly and better if the learning situation produces satisfaction.

Thought must therefore be given to:

Avoiding austere, uninviting interiors in classrooms, libraries, and other areas

Avoiding the confining, cell-like enclosures of conventional classrooms by use of orientation, fenestration and other means so they open out rather than restrict

Providing ample display areas for student-created, not just teacher-created, products

Avoiding unsightly and unfriendly obstacles which children may meet passing from one area of the school to another or from their entrance to their stations

Using color imaginatively, for satisfactory esthetic effect upon pupils (rather than adults), avoiding dull, institutional colors

Employing heating and ventilation to provide proper atmosphere for work. Learning is work. Temperatures over 72 are not conducive to quiet work. Air conditioning is a must in areas to be used in summer months. Zoned heating is essential to provide low temperatures in physical activity areas.

Assuring safety and sanitation by avoiding exposure to radiation, water that is too hot, sharp corners, fire hazards, protruding obstacles in corridors and passageways

Some Emerging Educational Developments

There has been considerable experimentation in education in recent years and several developments of current interest have a bearing upon what an elementary school might be like in the future. Recent innovations in elementary education include:

1. Revision of subject matter content, *e.g.*, new materials in Science and Mathematics replacing the traditional ones; the introduction of foreign languages

2. Devices for greater adaptation to individual differences, *e.g.*, improved pupil personnel programs, ability grouping, individual study plans, ungraded classes, programmed instruction, teaching machines, program enrichment, etc.

3. Plans for greater efficiency in use of teaching personnel, *e.g.*, team teaching, use of closed-circuit television and television broadcasts, variations in sizes of instructional groups, teacher aids

There is no way of knowing what will be adopted as the educational program in a genuinely experimental elementary school. Little can be said categorically about any of the new ideas about organizing schools and teaching except that there is evidence that each has proven useful in certain schools with certain groups of students and teachers under certain conditions. Such innovations as use of educational TV, for example, have had a great impact on some learners in some situations, but not in others. Schools which find ways properly to fit ETV and other visual-auditory devices into their programs will unquestionably benefit.

What this means for school planning cannot be spelled out in detail. Some conclusions are evident:

1. Provide as much flexibility in spaces as possible

2. Plan to have rooms larger than conventional classrooms for possible future uses requiring more space

3. Have classrooms larger than formerly to allow for additions of counters, other work spaces and storage for

new teaching aids and materials not immediately anticipated

4. Provide adequate storage space throughout the structure

5. Provide conference rooms and work spaces for teacher planning

6. Have ample electrical outlets in all rooms

7. Arrange for spaces in classrooms, laboratories, in the library and elsewhere for independent study and research

8. Where feasible, design spaces for multiple use

9. Structural design should permit easy access to spaces where utilities (conduits, etc.) might be needed

10. Anticipate continuous technological obsolescence of electronic and similar teaching devices

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LABORATORY SCHOOLS IN PERSPECTIVE

An examination of the more sophisticated literature in education relating to laboratory schools reveals a few things of interest. Few studies have been made of an evaluative character. The bulk of the literature is discursive and historical in nature. Nevertheless there can be gleaned from this a number of points which have a bearing on the subject of the development of experimental centers in the Commonwealth of Pennsylvania state colleges.

Early History of the Laboratory School

The laboratory school has had a long history, having originated with the earliest teacher-training institutions. When it is realized that in this country the first on-campus schools were created in the early part of the nineteenth century, one is not surprised to find in the literature that such originators of the normal school as James G. Carter and such educational statesmen as Henry Barnard urged that "practice schools" be provided for teacher training. At that time public education in this country was in its infancy and few, if any, schools were suitable for the major functions of observation and practice. It is not therefore surprising that the early laboratory schools or "model schools" were intended primarily for observation and practice teaching.

Meanings of "Laboratory School"

In the literature there is much confusion as to the meaning of the term "laboratory school". The confusion probably is due to the two kinds of meanings that we have in higher educational institutions for laboratories in other fields. We have laboratories for teaching purposes; we have laboratories for research purposes. Most of our laboratories in the sciences in our higher educational institutions are not for purposes of demonstrating new knowledge about science, or developing new knowledge about science. Generally speaking, our teaching laboratories in use for freshman chemistry, for instance, are places in which students have an opportunity to supplement what they learn from reading and listening by actually manipulating substances with the physical equipment of a laboratory designed to give them live experience.

The college research laboratory, on the other hand, is designed for purposes of experimentation. There are some who use the term "laboratory school" who evidently have the second connotation in mind. Certainly John Dewey, when he was experimenting at the University of Chicago, had the experimental school in mind when he said:

> "The conception underlying the school is that of the laboratory. It bears the same relation to the work in pedagogy that a laboratory bears to biology, physics, or chemistry. Like any such laboratory it has two main purposes: (1) to exhibit, test, verify, and criticize theoretical statements and principles; (2) to add to the sum of facts and principles in its special line."

Historical Functions of the Laboratory School

In the course of this century, there have been a number of innovations, a number of fundamental contributions to knowledge about education and teaching, which have come from laboratory schools. However, in the main, their major functions have been to provide a place for students preparing for teaching to see how teaching takes place, to observe children and to have practice experience.

The emphasis on this function is suggested by the standards adopted by the American Association of Teachers Colleges which in 1926 indicated that teachers colleges should maintain a training school for purposes of "observation, demonstration and supervised teaching on the part of students."[1]

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[1] American Association of Teachers Colleges. Standards for Accrediting Teachers Colleges. Yearbook of the Association of American Teachers Colleges. Oneonta, New York: The Association, 1926. p. 11.

The history of the laboratory schools in teacher education is one of emphasis upon the observation and practice functions. However, beginning in the latter part of the last century and the turn of this century there were some distinct departures. One of these was the school that later became the Chicago Normal College under Francis W. Parker, in which the entire work of the practice school was concentrated upon "experiments and investigations" on the work of teaching. Schools under the leadership of Dewey and Judd at the University of Chicago, Meriam at the University of Missouri, Caldwell at Teachers College, Columbia University and Zirbes at Ohio State mark the beginnings of an emphasis upon the experimental function.

In recent years, professional associations have encouraged the experimental and research functions for college-controlled laboratory schools.[2]

Also a third function has been added, that of providing leadership in improving educational opportunities in the area served by a teacher-training institution.

Typical of the early conception of functions of the laboratory school is the following, from the catalogue of the normal school at Millersville, Pennsylvania for the year 1887-1888:

> "The practice teaching in the Model School is an indispensable part of the Professional Course. To know how to do is one thing; to be able to do is quite another. No matter how thoroughly one may understand the science of teaching, it needs actual practice under careful supervision to attain skill in the art. Instruction in the science of teaching is therefore supplemented by the practice of teaching in a Model School."[3]

Schools since then generally have added the experimentation function, but still emphasize observation and practice. There are notable exceptions. The Ohio State University Center for School Experimentation and the University High School at the University of Illinois are examples of college-controlled laboratory schools in which the orientation is primarily research and experimentation.

The following statement of the College of Education, Ohio State University, describes the function of the laboratory school at that institution:

> "The Center for School Experimentation, which incorporates the University School, is charged with mobilizing the resources of the School, the College of Education, and the University to find better answers to instructional problems. Its major concern is with experimental program development and research-oriented in-service education, although it also sponsors basic research.

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[2] See summary of panel discussion in the Thirty-Fourth Yearbook of the Association for Student Teaching. Functions of Laboratory Schools in Teacher Education. Lock Haven, Pennsylvania: The Association, 1955. p. 150-51.

[3] Association for Student Teaching. The Outlook in Student Teaching. Forty-First Yearbook of the Association for Student Teaching. Lock Haven, Pennsylvania: The Association, 1962. p. 10.

> "The Center brings University resources into relationship with concerned public-school personnel of the state. At present, twenty-eight school systems, enrolling 25 per cent of the public schools in Ohio, are affiliated with the Center in ongoing studies. Many others are or have been associated with the program of the Center through consultation by Center personnel, intervisitation, or attendance at Center-sponsored conferences on campus."[4]

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[4] The College of Education, The Ohio State University. "Center for School Experimentation". The College Crier Vol. 1, No. 2. Columbus, Ohio: The University, Winter Quarter 1962.

A brochure of the University High School, the experimental secondary school of the University of Illinois, has this to say about its functions:

> "The functions of University High School are:
> "1. Carrying on experimentation with the content, methods and materials of secondary education.
> "2. Contributing to the teacher education activities of the University. Contributions are being made through providing limited observation facilities and practice teaching.
>
> "As Function 1 has been increasingly developed, the experimentation has resulted in significant findings with important implications for both pre-service and in-service education of teachers. Thus new means of dissemination, such as the production of movies, have been developed and the teacher education function is now receiving increasingly greater attention in relation to Function 1.
> "3. Providing secondary education of outstanding quality for the pupils who are enrolled.
>
> "The providing of opportunity for secondary education is not per se the proper function of the University. Nevertheless, the acceptance of responsibility for experimentation in the field of secondary education and of the responsibility of teacher training in the field justifies the continued operation of the high school. An adequate program of experimentation can be carried on only if the University High School is prepared to provide adequate educational opportunity for the students enrolled therein."[5]

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[5] The University of Illinois. University High School - The Experimental Secondary School of the University of Illinois. Urbana, Illinois: The University. p. 5.

Present Trends and Functions of Laboratory Schools

There are some trends of note. One of these is that it has long since been necessary to move practice teaching in great part off campus. The economics of providing a campus-operated school for all of the practice teaching required in an institution that has a high volume of teacher training is prohibitive. There is a consideration of research and experimentation in many schools based on stated objectives in catalogues and brochures, though in the main, these statements appear to be largely lip-service to the objective of experimentation or are indicative of this function only as secondary or tertiary to other purposes.

In general, the major purposes are still observation and demonstration, with some practice teaching. There are a few exceptions about the country where the emphasis is upon experimentation. In some cases, as was the case with the Horace Mann-Lincoln Institute, it was felt that the experimental objective was better served by the use of schools and student populations off-campus, on the grounds that many types of research involved a more normal situation.

Some state-wide facilities planning studies have raised questions about providing facilities for on-campus laboratory schools. One of these was the Re-Study of Needs of California Higher Education, published in 1955, in which it was recommended that action should be deferred on a university elementary school and on laboratory schools in state colleges pending a careful study of the effectiveness of such schools. It was recommended that such a study should deal with the relative effectiveness of teachers who have access to such schools as compared with those who do not have such access and with the over-all contributions which laboratory schools make to the profession of teaching.

Disadvantages of Campus Laboratory Schools

Among the disadvantages of laboratory schools is the high cost of maintaining such facilities. It is often pointed out that the conditions are artificial. This may be a distinct advantage for certain types of experimentation for which controls not feasible in public schools are required.

Summary of Functions

In summary, the different kinds of reasons for the existence of a school on campus are as follows:

1. To provide opportunities for professional laboratory experiences including observation, demonstration, and student teaching.

2. To provide opportunity for research and experimentation.

3. To provide leadership in improving educational programs in areas served by the institution.

4. To provide a superior type of instruction for a group of children attending the school.

A possible additional function, though not commonly stated, is implied in some of the work of some laboratory schools. The statement cited above for the Center for School Experimentation at Ohio State indicates that there is a type of field service and consultation emanating from the Center with schools in its service area. It is general practice for the field service function of a teacher training institution, however, to be separate from the laboratory school itself.

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TRENDS IN FACILITIES FOR ELEMENTARY EDUCATION

Recent elementary school buildings in the United States, to the casual observer, are radically different from those built a half a century or more ago. To be sure, there are marked differences in appearance -- differences due to changes in structural design, new materials for interior finishes and the like. Basically, however, in terms of space allocation itself, most recently constructed elementary schools differ little from those of a generation or two ago.

There are, nevertheless, significant developments in elementary school design which are indicative of possible future facility requirements. It is to be noted that these developments have come about partly in response to a need for re-examination of the elementary school program and methods of best accommodating it. Changes in construction technology, the pressures of economy and architectural fashions have left their marks.

Early departures from the standardized elementary classroom have been noted in the 1930's and early 1940's. But many traditional classrooms still exist and many are still being built.

We are speaking not of the Kindergarten, which has developed its own set of standards, but of facilities for children in the age groups accommodated by what we now call grades one through six.

Limitations of the Traditional Elementary Classroom

Width: 22 feet

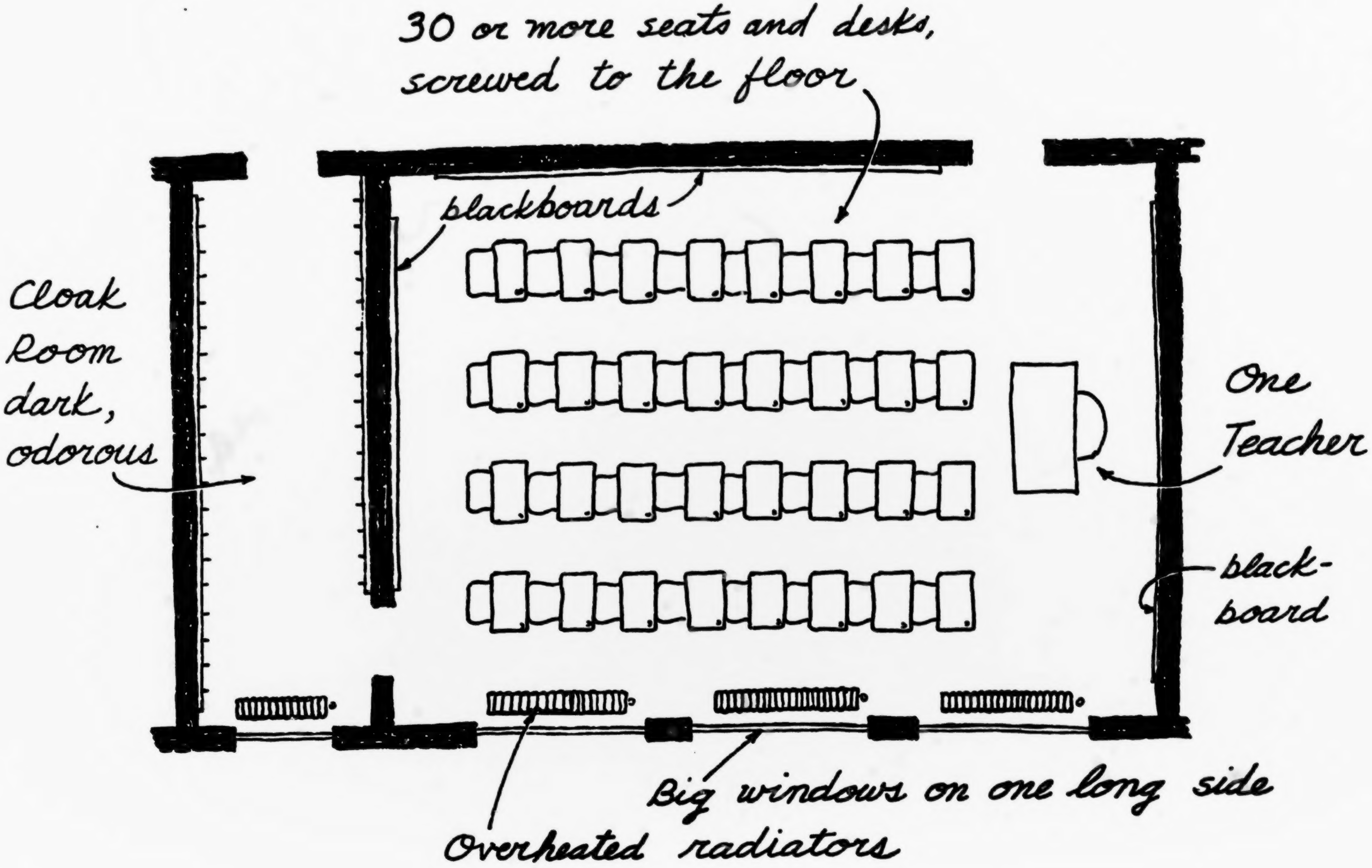
Length: 30 to 32 feet

Stations for: 30 pupils and one teacher

Fenestration: unilateral, of predetermined
amount and position

Chalkboard: maximum

Tackboard: minimum


30 or more seats and desks, screwed to the floor
blackboards
Cloak Room dark, odorous
One Teacher
black-board
Big windows on one long side
Overheated radiators

TRADITIONAL ELEMENTARY CLASSROOM

22 ft. by 30 ft.

Cloakrooms, alcoves, cubicles or lockers

Artificial lighting: low intensity, questionable quality

Heating and ventilation: governed by minimum legal requirements

Walls: indestructible

Coloration: depressingly institutional

Sound control: not considered

This is the traditional classroom, its design featuring the following:

1. Teacher dominance. This was expressed by placing the teacher at the entrance end of the room, facing regimented rows of children's desks.

2. Classrooms unrelated to each other. Each class was assumed to be self-contained and the total environmental effect of containment was accepted.

3. Inflexibility.

   a. Of function, fixed by class size and teaching program.
   b. Of structure, determined by accepted building technology requiring heavy bearing walls surrounding the classroom for a number of predilections and formerly practical reasons.

4. Limited need for facilities.

   a. Seats and desks fixed to the floor.
   b. Educational materials limited to pencils, paper, books, chalk, blackboards, erasers.
   c. Little storage space required.

5. Faulty conceptions of environmental control.

   a. Dependence on natural lighting, which rigidly defined windows, determined room width and limited room location to a position with one long wall on the building's exterior.

b. Heating and ventilating similarly determined by limited technical knowledge.

c. Faulty emphasis on maintenance, aimed at economy, control and containment at the expense of educational inspiration.

d. Other elements of environment not considered due either to lack of knowledge or to regarding them as inappropriate.

Accommodating Broader Scope of Activity

Attempts to increase, vary and intensify learning experiences in elementary schools have made demands which have in many instances changed the characteristics of the elementary classroom. Some of the new characteristics are:

1. More space. Instead of 650 to 700 square feet, elementary classrooms of 800 to 1,000 square feet are now common.

2. Movable equipment. Not only chairs and desks (or often tables), but also many other kinds of teaching equipment have been made movable so that children may be grouped and regrouped as learning activities change during the school day.

3. More kinds of equipment. These are for pupils to manipulate, look at and listen to, and require locations convenient for the grouping and regrouping referred to above.

4. Special spaces. Special facilities in specially devised locations, such as work alcoves, have been experimented with; this development has been questioned and sometimes abandoned as tending to re-introduce inflexibility.

5. More storage. This has been provided not only for pupils' personal effects (clothing, work projects, etc.), but also for the great variety of instructional materials and teaching aids.

6. Use of out-of-doors. Outdoor spaces contiguous to classrooms have been developed for such uses as formal

instruction, children's gardens and projects.

7. Display space. Products of and resources for expanded learning experiences require more tackboard and other display facilities.

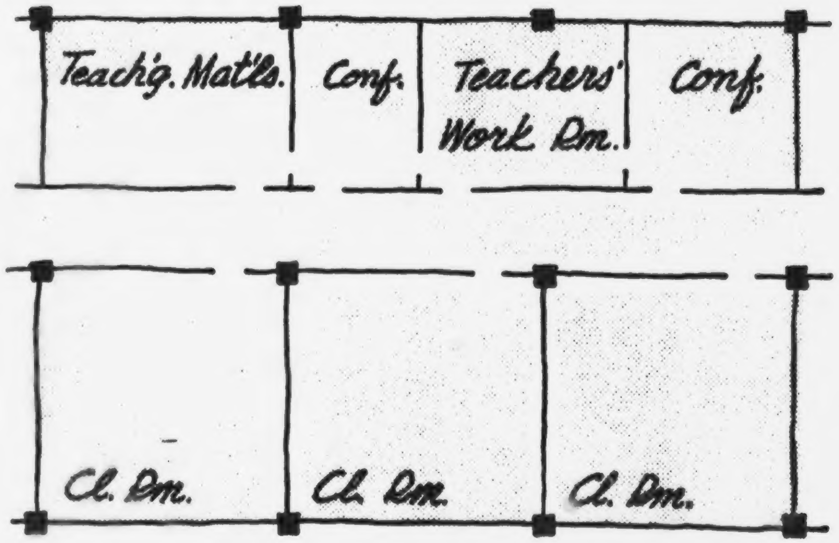
Attempts to Accommodate Departures from the Self-Contained, Single-Teacher Approach to Elementary Education

Some liberalization of the concept of the self-contained classroom is evident in the kinds of facilities so far described, but these are not radical departures from the self-containment concept. Other attacks upon accepted educational procedures, however, presuppose that self-containment in single-teacher groups is not the only, and perhaps not the best, type of organization for elementary education. These have resulted in experimentation with structure, space type and organization and equipment. Many such devices are much older than the new labels they have recently acquired. The major approaches include:

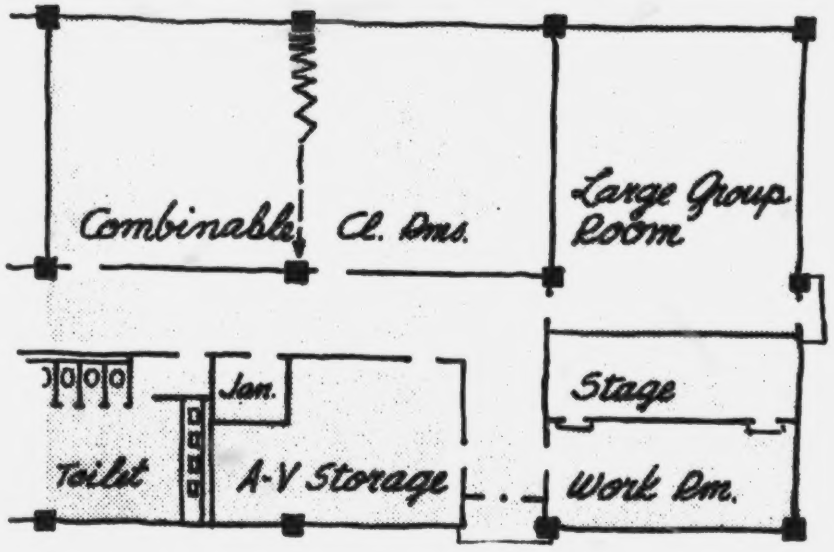
1. Flexibility of structure. Structural flexibility permits enclosing a variety of sub-spaces for a variety of uses. It is often the result of a desire to produce efficiency in design, for instance, by using space modules or minimizing internal supports. Its functional uses include:
   a. Permitting multiple use of spaces.
   b. Facilitating future changes in spaces.
   c. Convenience in enlarging or reducing spaces readily. This has revived the use of the operable wall.

2. Clustering of spaces. Teaching spaces are grouped in clusters to serve such ends as:
   a. Accommodating team teaching, ungraded school organization, or similar reorganization of instruction requiring a close affinity of spaces within clusters or a separation of clusters.
   b. Reducing the mass of the social group to which children must adapt.
   c. Realizing advantages which unit construction might have on costs.

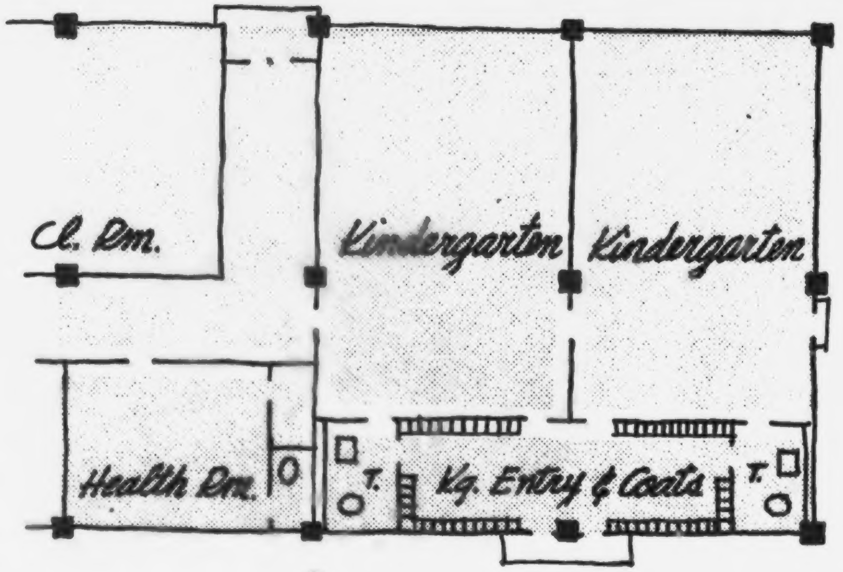
3. Supplementary spaces. An enriched program has tended to require facilities not all of which can be accommodated in classrooms:
   a. For large groups of children (for presentations, lecturing, eating, large project work,


Teach'g. Mat'ls.
Conf.
Teachers' Work Rm.
Conf.
Cl. Rm.
Cl. Rm.
Cl. Rm.

1


Combinable
Cl. Rms.
Large Group Room
Toilet
Jan.
A-V Storage
Stage
Work Rm.

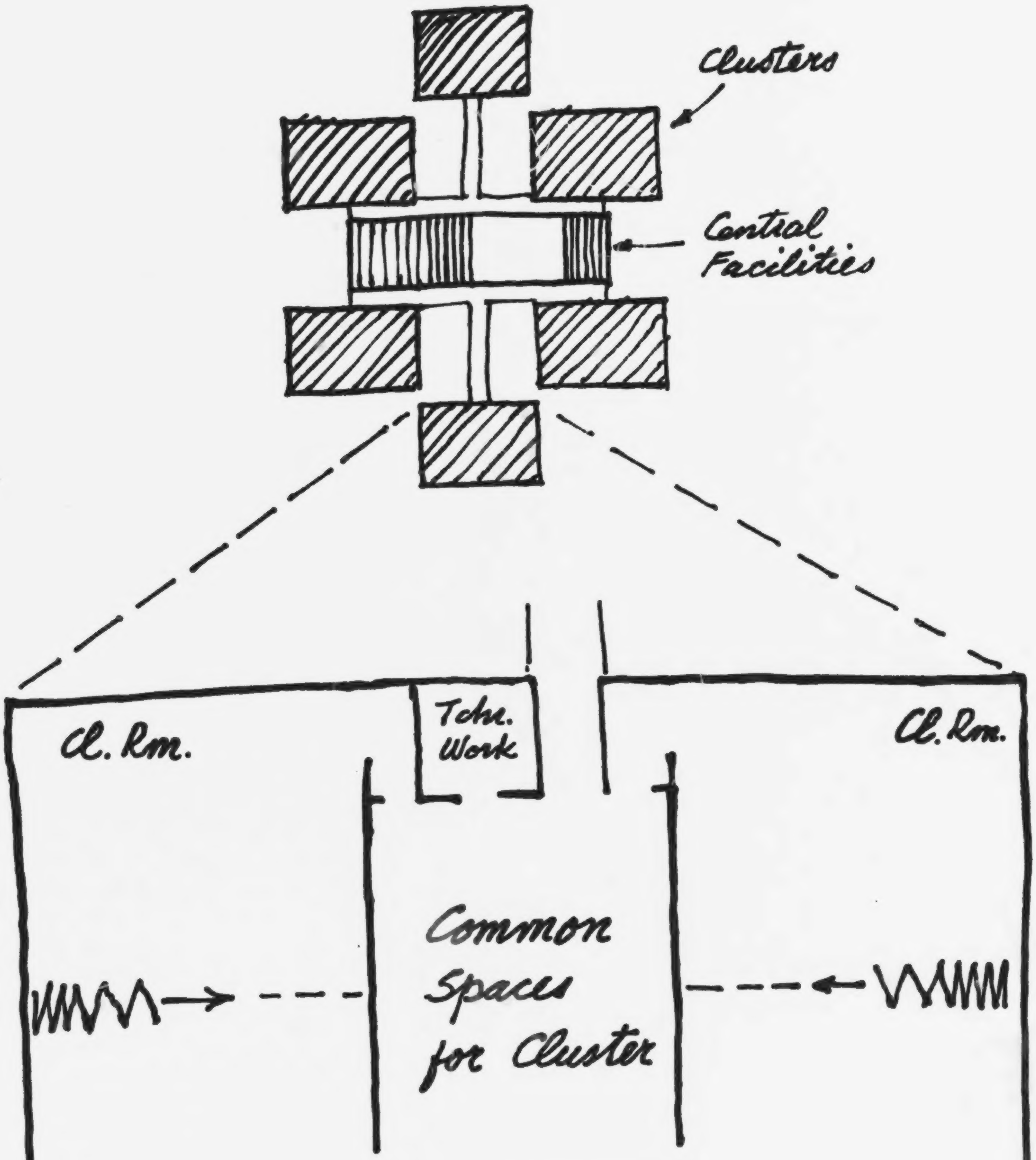
2


Cl. Rm.
Kindergarten
Kindergarten
Health Rm.
T.
Kg. Entry & Coats
T.

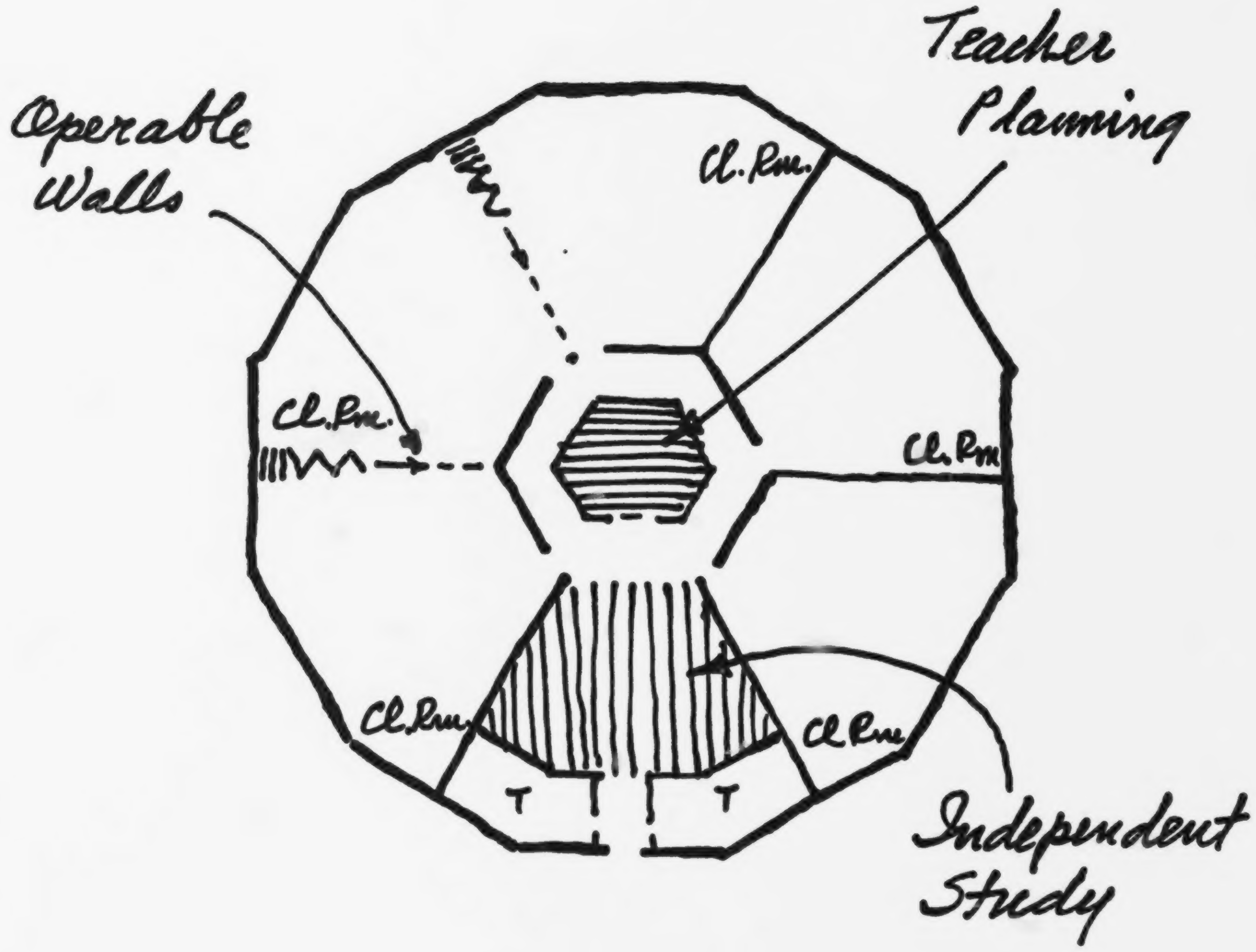
3

Note: bearing walls eliminated

STRUCTURAL FLEXIBILITY: *Isolated supports accommodate a variety of space arrangements*


Clusters
Central Facilities
Cl. Rm.
Tchr. Work
Cl. Rm.
Common Spaces for Cluster
Cl. Rm.
Cl. Rm.

CLASSROOMS IN CLUSTERS


Operable Walls
Teacher Planning
Cl. Rm.
Cl. Rm.
Cl. Rm
Cl. Rm.
Cl. Rm.
T
T
Independent Study

EXAMPLE OF CLUSTERING WITH SUPPLEMENTARY SPACES AND COMBINABLE SPACES some types of teaching aids).

b. For small groups of children (for discussion, small group projects and activities).

c. For independent work and study.

d. For teachers to plan and prepare individually and jointly.

e. For guidance and counseling as a continuous part of the school program.

f. For equipment as indicated below.

4. Specialized equipment. Either in or outside of classrooms special equipment is needed.

a. Techniques involving physical activity and special equipment (as constructing, painting) require more space than conventional classroom lecture-recitation methods.

b. Some techniques such as passive viewing (of slides, films, educational TV, etc.) or listening (to tapes, records, sound tracks, FM radio) require extensive control over internal environment (heating, ventilation, lighting, acoustics) as well as optimum space organization and special equipment installation. Sometimes the necessary space characteristics appear to be so specialized that separate areas or rooms are provided and the children move to the experience. This is little different from the work-alcove concept already described, and again introduces a degree of inflexibility. Constant improvement of equipment (as projectors and screens, high-fidelity, noise-excluding earphones) tends to render obsolete the over-specialized space.

c. Types of equipment that are very complex or too expensive for duplication in all instructional spaces are often stored in a resource or materials center and moved to the children as needed (examples: elementary science materials, teaching machines, tapes, recorders, records, projectors, films, other A-V materials).

d. Materials used for some techniques must be originated elsewhere, within or without the school, in order to expose all pupils to superior teachers or programs (educational TV, open- or closed-circuit; radio, films, recordings). Space and equipment provided range all the way from complete production studios to simple provision of storage and adequate wiring.

Attempts to Improve the Educational Environment

The educational environment consists of the shape, dimensions and relationships of spaces as well as their treatment. Although much is known about the requirements for such factors, their application in elementary school design remains as much an art as a science.

1. Space relationships have become complicated because, as the "things" of education (materials and specialized devices) have multiplied, we have tended to put them in separate compartments and move pupils and teachers to them, or at times to move them to the pupils. The activity of education, as well as the special nature of some facilities, increases the complexity of space requirements.

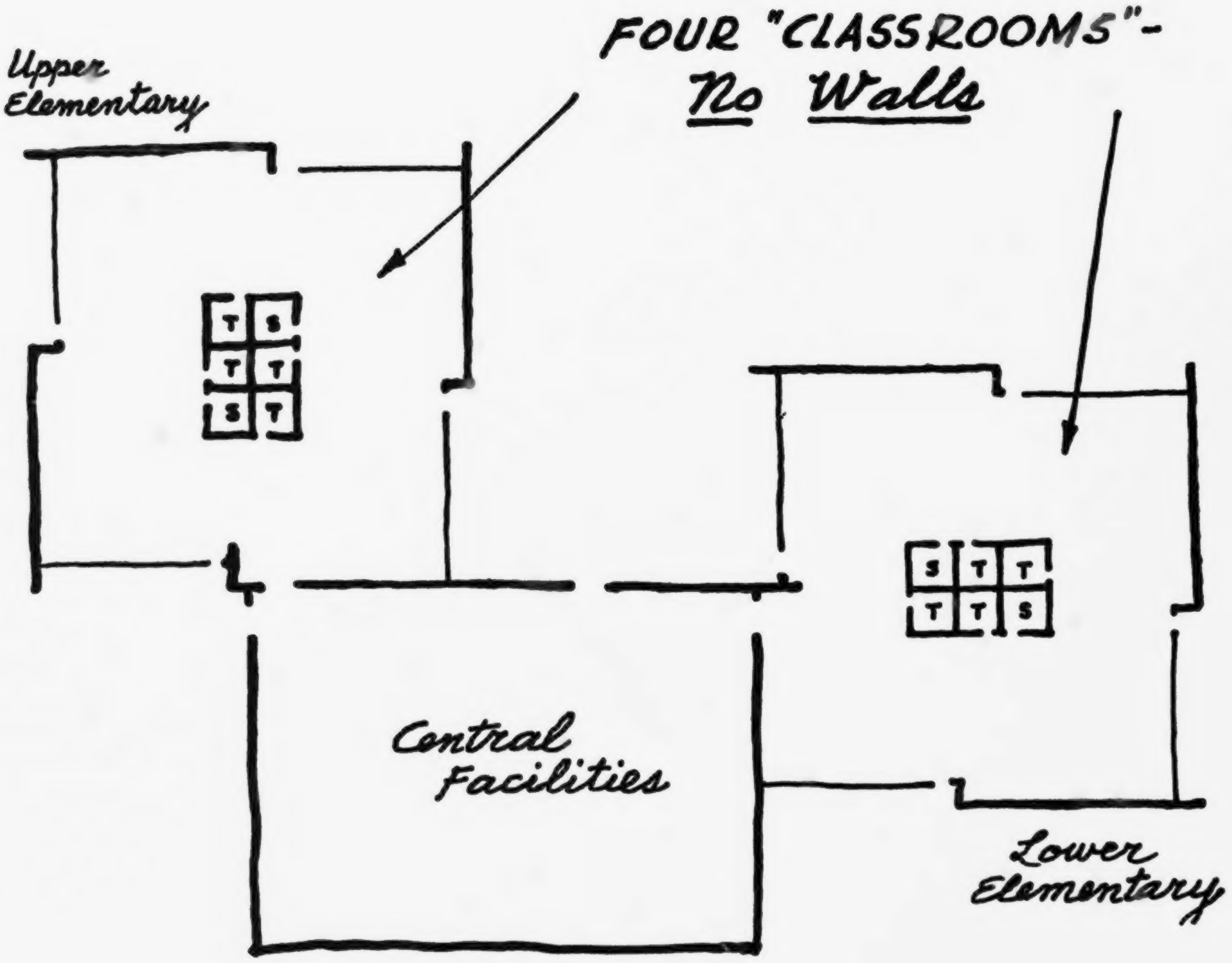
One attack on this type of problem, motivated also by the desire for economy, has been to design one space for several functions. Sometimes this produces rooms which in attempting to meet several types of demands really satisfy none.

Another attack originated in the desire for economy and has begun to acquire educational respectability. This started from the assumption that corridors were waste space, leading to experiments providing access from room to room with no corridors. A later development consisted of teaching spaces that opened partially into one another. Portions of interior walls became glass and even began to disappear.

Recently this trend has developed into large spaces for several classes without any partitions at all, save those essential for privacy or efficient storage. An extreme example is a very recent proposal for an entire school without interior partitions, in which classes and activities are to be separated by semi-portable cabinet work . This, as with the less extreme schemes, has necessitated ever-increasing control of noise.

2. Shape and dimension of spaces for elementary education have developed paradoxically. As equipment and square feet of floor area were added to the traditional elementary classroom it became evident that the 22-foot standard width was unsatisfactory. A 900 square foot area only 22 feet wide would be 41 feet long. The equipment further encroached on the effective room width. The self-contained, single-teacher classroom became square, and the new shape was found to accommodate well the new concepts of multiple activities in small groups, simultaneously or at different times.

Room height was traditionally controlled by dependence on natural light from windows on one side of the room. But as rooms became more square, unilateral lighting became inadequate. Multi-lateral lighting (windows on two


FOUR "CLASSROOMS"-
No Walls
Upper Elementary
T S
T T
S T
S T T
T T S
Central Facilities
Lower Elementary

FLEXIBILITY: *by eliminating partitions between classrooms* or more sides), top-lighting through roof monitors like those used in factories, or by means of skylights, were among the experiments. It became evident that the shape and size of the educational space, determined by the nature of educational activity, seriously affected other aspects of environmental design. Heating, ventilating and acoustical control were likewise affected by shape and dimension as well as by room use, as we shall see.

Other forces have affected room shape and size: specialized seeing and hearing needs for some types of demonstrations and audio-visual aids; economy of construction; utilization of ceiling, floor and wall surfaces to improve vision, lighting and sound distribution.

Whether a television receiver, for example, is located in a multi-purpose or a specialized teaching space, viewing angles and distance determine correct location of both seating and the TV receiver. On a large screen the increased scale of the projected image increases the desirable distances between seats and image but does not change the viewing angles. As emphasis on audio-visual devices has increased, there has been increased interest in fan-shaped rooms and, in extreme cases, in sloping floors and non-level ceilings to improve seeing and hearing.

Examples of the effects of economy are the "end-on" classroom (short wall to the exterior, reducing periphery and corridor length, both resulting in lower costs) and other geometrical solutions which, by using segments of circular buildings or triangular, pentagonal or hexagonal rooms,purportedly reduce exterior walls and hence reduce costs. Often, however, untenable and esoteric assumptions or predilections appear to be the real basis for selecting these shapes.

In truth, no one knows exactly how shape of space affects learning, except for such special cases as viewing angles, light distribution and the like. How children react or how their learning changes as room shape varies, or if any change occurs at all, has not been determined.

3. The outdoor environment has been developed for various learning and living needs of pupils and teachers. Their use is limited by conditions of climate.

The indoor spaces also require protection from the vagaries of climate: extremes of temperature, natural light, air motion (wind), and noise. Some of these needs will be accentuated if we increase the school year from nine months to twelve, but during certain periods of the nine-month year outdoor conditions are so uncomfortable even in northern latitudes that precautions must be taken.

Protection from sun heat and direct glare from the sky as well as the sun has taken many forms, from roof overhangs, horizontal exterior louvers, and some exceedingly complex devices, to interior venetian blinds, horizontal or vertical. There has been much experimentation with glare-reducing glass.

Sometimes we have forgotten that light and heat reflected from adjacent walls and pavements, or from snow in winter, can become equally serious problems.

But all these efforts toward controlling the effects of exterior environment increase the cost of educational facilities and many are only partially successful. Technological advance now makes it possible for us to control completely the indoor environment, independently of what the outdoor climate may be.

4. Heating and ventilating were once considered independently of each other. With the advent of air conditioning we have come to consider temperature, air replacement, air motion and humidity as parts of an over-all problem even when the sources of heat and air are independent of each other. The less outdoor conditions are permitted to interfere with indoor climate, the simpler becomes the design of the necessary mechanisms and, when properly designed, the lower their cost. This has given strong impetus to reduction of window area, even to elimination of windows entirely.

5. Artificial lighting equipment and standards of design have likewise progressed, with comparable effects. The contribution of colors of walls, ceilings, floors and furniture to the total lighting environment can now be determined with reasonable accuracy. So can the deleterious effects of glare from numerous sources, the good and bad effects of contrasts of light and dark surfaces, and the amount and quality of light reflected into the student's eyes from whatever task he may be engaged upon. This approach evaluates visual environment in terms of the critical test of what pupils are able to see rather than simply how much light in foot-candles is available from the light source.

6. In control of sound the story is similar. Technical knowledge and devices have multiplied since World War II. The layman thinks of acoustical correction as the control of unwanted sound or "noise"; this we can now do, and in addition we are learning how to control the distribution and quality of sound by shape of space and reflectivity of the enclosing surfaces.

In other words, we can make sound behave as we wish it to, although admittedly this is sometimes expensive. An operable wall, for example, cannot fit too tightly if it is to be easily operated, and sound leaks through apertures as water does through a sieve. Such a wall cannot be too heavy, yet weight -- mass, as the physicists term it -- is the best barrier to sound transmission.

Investigation of such matters has led to a current belief that a certain level of incidental sound, usually fairly low, may be desirable to mask and render less troublesome occasional inescapable noise; that by indicating the presence of others engaged in common pursuit of educational ends this acoustical perfume or ambient noise level is positively beneficial. What the acceptable limits may be is difficult to determine. To what extent this concept is based on fact is uncertain.

7. Use of a variety of color in newer elementary school facilities is one marked contrast with older schools. Selection of color has been predicated upon light reflectivity and upon esthetic judgments or personal taste. Consideration is given, for example, to appropriate compass exposures as regards the "warmth" or "coldness" of some colors, or to those colors which young children "like" and to which they will respond desirably.

There is no reliable rationale that tells us how we can use color to stimulate desirable emotional, physical or intellectual behavior. Attempts in this area are based on doubtful assumptions. Lacking accurate information, dependence is placed upon the predilections of the designer and of the people who use the space.

Summary

The elementary school building thus appears to have adapted in the past quarter century to changing requirements of the school program and to the developing technology of construction. Yet there are only rare examples of departures from the traditional elementary school design which exhibit attempts to refashion space and equipment for reasons of fundamentally new conceptions of elementary education itself. There are a number of significant technological advances permitting economy of construction and improved environmental conditions, though many questions remain unanswered when it is attempted to maximize the usefulness of space in elementary schools under a variety of program requirements.

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LARGE-GROUP INSTRUCTION SPACES

Large-group learning spaces, as distinct from conventional, standard-sized classrooms or seminar rooms, serve an instructional function largely limited to lecture-demonstration or similar presentations. By large-group instructional space is meant a space designed for a capacity of more than approximately 50 students. The number might range to as many as 300.

The design problem for such spaces relates, therefore, primarily to the provision of effective methods of dissemination of information, the delivery of planned presentations and suitable conditions for student reception of information. Primary considerations are the method of presentation of visual and auditory materials, desired features of the visual and auditory environment and suitable places for the preparation of program material. An excellent report of the subject may be found in New Spaces for Learning, a design study prepared by the School of Architecture of the Rensselaer Polytechnic Institute.[1]

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[1] Harold D. Hauf, Wayne F. Koppes, Alan C. Green, Morton C. Gassman. New Spaces for Learning - Designing College Facilities to Utilize Instructional Aids and Media. Troy, New York: School of Architecture, Rensselaer Polytechnic Institute, 1961.

Functions Served

Here are the circumstances under which large-group spaces prove useful:

1. When there are sufficient numbers of individuals (pupils, students, others) on a sufficient number of occasions who may be scheduled to use it. It is more economical to have several small teaching stations than one large one if grouping for instruction is by conventionally-sized class groups. Unutilized auditoriums and large lecture rooms are extravagant.

2. When instruction is organized so that lecture-demonstration methods can be suitably separated from teaching and learning which are not lecture and

demonstration and handled elsewhere. Large-group instruction is a mass teaching device by which students become primarily viewers and listeners.

3. When there is no other mechanism, such as closed-circuit television, for satisfactorily reaching large numbers of individuals in several different classrooms. There is no evidence that the social or spatial environment of a 100 to 300 capacity teaching space in itself adds to learning.

Research indicates that there is no significant difference in many subject areas between lecture-demonstration and discussion methods in teaching, as measured by subject-matter tests. If large-group, lecture-demonstration methods are to be used, it is necessary that they be used in such a manner that results may be expected to be at least as good as those by other methods. This suggests the desirability of using audio-visual equipment and other devices which will be preculiarly adapted to making large-group instruction effective.

It is unlikely that all uses in the normal course of instruction will require elaborate devices. Moreover, studies do not show great advantages in supplementary visual aids over standard lectures in many subject fields. However, in large instructional spaces the critical requirement is vision and hearing. Small demonstrations and some chalkboard material cannot be viewed, for example, at great distances. Therefore, audio-visual aids in some form must be incorporated into large-group instructional spaces.

Factors related to large-group instructional spaces are lighting, acoustics, mechanical equipment, equipment and fixtures, image viewing and projection methods.

Lighting

The objective in planning lighting for such spaces is to provide visibility, comfort, composition and atmosphere. Specific considerations are the following:

1. Little or no natural light is required.

2. Proper light for note-taking by students is desirable.

3. Special lighting should be considered for demonstrations, models, etc., at demonstration areas.

4. Appropriate light for the instructor's station for reading lectures, for taking notes, etc.

5. Illumination for display areas, tack spaces, etc.

6. Provision of dimmers and centralized light control.

7. Exit lighting.

8. Avoidance of undesirable shadows and excessive contrast ratios.

9. Light intensities as recommended by I.E.S. standards.

Acoustics

One of the main concerns of the large-group learning space is the provision of good conditions for hearing. Basically, the acoustical objectives are:

1. The provision of a satisfactory acoustic environment by raising barriers to unwanted sounds or noises.

2. The provision of good hearing conditions by controlling the distribution of wanted sound.

3. Keeping sound originating within the space "within the space".

Sound systems are basically of two types:

1. The central high level system with a single loudspeaker located in the center front of the ceiling or on the front upper part of the front wall. (For learning spaces the central high level system appears to be most feasible.)

2. Distributed low level systems with loudspeakers located in the ceiling, facing down and covering only a localized area.

Various studies point out that loudspeakers should not be located on side walls of the room.

Heating and Ventilating

Another important facet to the large-group learning space is the mechanical equipment. Certain conditions arise from the nature and use of these spaces requiring specific considerations and care in their design. These conditions are:

1. Spaces under consideration preferably should have no windows.

2. The number of occupants per unit volume will be relatively large.

3. A good deal of electrical heat producing apparatus will be used.

4. The normal visual environment for projection may be conducive to drowsiness, an effect which may be reduced by well-designed air conditioning.

Equipment

In addition to seating and note-taking facilities for viewers, equipment is required for demonstration and for producing images and sounds. Various types of "live" demonstration may be necessary in large-group teaching stations. In order to maximize use, there should be provision for lectures and demonstrations using little or no audio-visual devices. Convenient demonstration facilities are needed for various subjects if the space is to be used by all disciplines.

Several plans have been suggested for this. One is a circular revolving platform serving as the demonstration area. This permits advance preparation of displays and demonstrations and rapid shifting of some into the presentation area. Another is the use of modular carts on tracks which can be moved into position, at will, from adjoining storage and preparation areas.

Among various types of instructional facilities which may be used advantageously for large-group instruction are:

1. Movie projectors
    a. With sound or without sound
    b. Rear screen or front screen projection

2. Other projectors -- front or rear screen
    a. Slide
    b. Film strip

    - c. Opaque
    - d. Micro

3. Sound systems
    - a. Public address system
    - b. Tape deck
    - c. FM and AM radio
    - d. Record players

4. Television (open- and closed-circuit)
    - a. Large-screen receiver
    - b. Standard sized monitors

5. Lecture-demonstration area facilities
    - a. Remote control devices
    - b. Light control devices
    - c. Easels for charts
    - d. Chalkboard
    - e. Exhibit space
    - f. Utilities for demonstration
    - g. Lectern
    - h. Teleprompter
    - i. TV cameras for projection of small operations or objects
    - j. Overhead projectors
    - k. Microprojectors
    - l. Opaque projectors
    - m. Instantaneous still camera
    - n. Microphones and various communications receivers as needed
    - o. Movable tables and carts

Production Facilities

Production facilities will vary greatly from institution to institution. Because many of the supporting elements in the production of programs to be presented in large-group teaching spaces serve more than one type of process, the space is likely to serve as a multi-use facility for an entire institution or complex.

Projected Image Viewing

In general terms, for an image to be viewed by the human eye, the following viewing conditions are recommended:

1. Minimum distance from screen equals 2W (W being the width of image).

2. Maximum distance from screen may vary from 6W to 7W.

3. Maximum horizontal viewing angle from axis, 30-45 degrees.

4. Maximum angle of elevation, 15-30 degrees.

The type of screen that is most generally acceptable for all-around purposes is the matte screen.

For rear projection, two types of translucent screens are identified:

1. Diffuse screen. These are screens which show a good image for a narrow viewing area.

2. Lenticular screens. These are made up of lens elements which control the direction of light transmitted and result in carefully defined acceptable viewing area.

For general use the diffuse screens appear more satisfactory.

For TV monitor viewing, the recommended optimum conditions are:

1. The minimum distance from screen equals 4W.

2. The maximum distance from screen equals 12W to 14W.

3. Maximum horizontal viewing angle from axis, 30-45 degrees.

4. Maximum angle of elevation, 15-30 degrees.

Front Screen Versus Rear Screen

There are essentially two methods of projection: front screen and rear screen.

Front Screen Projection. The basic advantages of front screen projections are:

1. Most available equipment is designed for front projection.

2. It conserves space, as projection beam occupies space above the heads of the audience.

3. A variety of suitable reflective screen types are available.

Some of the major disadvantages are as follows:

1. The operating noise of the equipment within the room.

2. Necessity of arranging seating to avoid interference with the projection beam.

3. Unless remote-controlled, either instructor or technician must manipulate the equipment.

4. Inconvenience of equipment stands, cables and so forth within the space.

5. Heat given off by the equipment difficult to control unless projection enclosure is used.

Rear Screen Projection. The rear screen projector is located behind the screen from the viewers and the image is displayed on a translucent screen.

This has the following advantages:

1. Projector is separated from the viewing area by screen -- the noise of operation and distracting presence of operator are removed.

2. Equipment can be prepared while classes are in session.

3. Possibility of audience interference with the projection beam avoided.

4. Heat given off by projectors easily exhausted from the rear projection space.

5. Instructor can point out details of image and

large demonstration apparatus can be used without casting shadows on screen.

Some of the disadvantages of rear projection are as follows:

1. Requires additional space outside seating area for equipment and projection beam.

2. May require equipment with higher brightness to provide images comparable to front projection.

3. Requires projectors with short focal length lenses and hence short throw distance to conserve space. There are several disadvantages to the short focal lens.

4. Instructor cannot manipulate equipment. Either it must be remote-controlled or operator must be stationed in rear projection area.

5. Limited amount of equipment presently available specifically for rear projection.

Summary

The major considerations in planning space for large-group instruction are:

1. An optimum viewing area and room shape, as defined by the various images and objects to be viewed.

2. Stepped or sloped floors may be necessary for best viewing conditions.

3. Windows are a liability rather than an asset.

4. All large-group spaces should be air conditioned.

5. Proper acoustic treatment in all rooms and sound isolation between rooms is required.

6. Carefully planned, special lighting is a prime essential.

7. The mechanical, structural, acoustical and lighting elements must be designed together as

coordinated systems.

8. The concept of a coordinated display surface or teaching wall should be considered.

9. Projection equipment should be instructor-controlled.

10. There are no overriding advantages of either front or rear projection; both should be considered.

11. A single large projected television image is preferable to a number of small, monitor images scattered about the space.

12. Adjunct service spaces which support the instruction area should be considered. Personnel preparing materials and operating equipment should not enter space during period of use. Adequate space for preparation of planned presentations and housing equipment are critical requirements.

13. Flexibility for multiple use is an essential objective in planning. Reliance upon a single medium of communication should be avoided. Live presentations require exhibit space, tackboard and chalkboard.

14. It is not necessary to include provision for all types of audio-visual aids in all large-group spaces. This will depend upon uses to which they are put. Space requirements for several types of aids are similar, so that minimum provisions can be made for accommodating most.

15. If emphasis is to be placed upon projected images, multiple screens may be advantageous. Whether a single screen or multiple screens, their location should not interfere with spaces needed for other types of presentation and origination.